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UME 41 FEBRUARY 1945 NUMBER 2

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OSTEOMA OF THE FRONTAL SINUS

REPORT OF FIVE CASES

MAJOR JAMES R. DOWLING

MEDICAL CORPS, ARMY OF THE UNITED STATES

A review of the literature of osteoma of the nial bones, especially that of osteoma of the ntal sinus, leaves one with a somewhat con- ed idea as to what osteoma really is. This due to the following reasons: First, this on is relatively uncommon; second, its cause ot known, and, finally, the gross morphologic microscopic studies have presented pictures t reveal wide variation. For instance, oste- a is portrayed by some observers as an ry-like tumor mass of eburnated dense bone, le others present a picture of a tumor mass ing a cancellous bony structure. Ewing ed that the bony structure may be ivory- with solid lamellas and with few or no ersian canals, or it may be spongy with can- ous tissue and may contain marrow cavities spaces. Schwartz [1] defined osteoma as a y tumor which exhibits neoplastic character- cs. For the main, one can be reasonably onciled to the view that osteoma is a bony or, benign and discrete, with variations in microscopic and morphologic appearance and undetermined cause.

INCIDENCE

Osteoma of the frontal sinus is by no means ommon lesion. Many an otolaryngologist has nt his life's efforts in a large and enterprising ctice without seeing a single case. Most of reports are of single cases, there being only nty reports of 2. Andrews (1887) reviewed 9,989 cases of ocular disease at the New York e and Ear Infirmary, the New York Oph- lmological and Aural Institute and the Man- tan Eye, Ear and Throat Hospital and nd only 8 cases of orbital exostosis, in 2 or f which this disease of bone probably origi- ed in the frontal sinus. Faulkner and Mac- nty [2] (1930) stated that in twenty-five years the last-named institution they had seen but cases. Teed [3] (1941) published a compre- hensive report on the results of an exhaustive survey of cases of this lesion. He found some 321 cases described in all medical literature. In the light of the previous statements I have felt most fortunate to have seen osteoma of the frontal sinus in 5 patients within the year 1944 at the Army hospital at which I am stationed. Since the formal opening date, Nov. 5, 1942, 7,129 patients have been seen in the ear, nose and throat clinic at this hospital for the first time. The present report has somewhat of an international interest by reason of the fact that 2 of the patients seen with this lesion were prisoners of war (German). It is my belief that the higher incidence of the lesion here is to be explained by the fact that osteoma of the frontal sinus, as statistics have shown, is chiefly a disease of youth and is more common in males. Eckert-Möbius [4] (1929) reported 180 cases; 110 of the patients were males and 70 were females. Teed (1941) in his survey found a ratio of 172 to 93. Consequently, the relatively high incidence at this hospital might be explained by the fact that an Army ear, nose and throat clinic cannot be looked on as a true barometer of the incidence of this lesion, owing to the homogeneity of the sex and age brackets in such a clinic as compared with those of a general civilian hospital. Since the greater number of cases which have been reported were European and in view of the fact that 2 of the patients in the present series were from Europe, it is not unreasonable to deduce that the lesion apparently is more common in European countries.

ETIOLOGY

The frontal sinus is the most frequent site for the development of osteoma of the nose and nasal accessory sinuses. Fetissof [5] after a survey

1. Schwartz, C. W.: Cranial Osteomas, Am. J. ntgenol. **44**:188-196 (Aug.) 1940.

2. Faulkner, R. F., and MacKenty, E.: Statement uthor while a resident at the Manhattan Eye, Ear, e and Throat Hospital, New York, in 1930.

3. Teed, W. R.: Primary Osteoma of the Frontal Sinus, Arch. Otolaryng. **33**:255 (Feb.) 1941.

4. Eckert-Möbius, A.: Osteom, in Denker, A., and Kahler, O.: Handbuch der Hals-Nasen-Ohrenheilkunde, Berlin, Julius Springer, 1929, vol. 5, p. 116.

5. Fetissof, A. G.: Pathogenesis of Osteoma of Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **38**:404 (June) 1929.

of over 200 cases reported that in 50.7 per cent the osteoma was situated in the frontal sinus, in 40 per cent in the ethmoid labyrinth, in 6.2 per cent in the maxillary sinuses and in 3.1 per cent in the sphenoid sinuses. Malan [6] surveyed 458 cases and found the frontal sinus to be involved in 178, or 38.95 per cent.

Most authors are agreed that osteoma of the frontal sinus is essentially a lesion of youth and that the greater incidence is found between the second and third decades of life. Carmody [7] reported that in his series of cases the youngest patient was 13 and the oldest 75. Since in most of the instances the lesion is the silent type and the diagnosis is made on a roentgenologic basis rather than on external inspection, the lesion is often present long before any symptoms appear. Teed [8] in a survey of 250 cases found that in 93, or 37.2 per cent, the lesion occurred in the third decade of life, compared with 63 cases, or 25.2 per cent, in which it appeared in the second decade, and only 8 cases, or 3.2 per cent, in which it developed in the seventh decade of life.

In the 5 cases seen here the ages were 21, 22, 29, 30 and 35 years, respectively, with a mean average of 27.4 years. Osteoma of the frontal sinus, therefore, would appear to be definitely a lesion of youth.

The cause of osteoma is unknown. Various theories have been postulated, the first of which holds that the origin is the embryonic rest. This view was first expressed by Arnold [8] and later was more fully explained by Gatewood and Settel.[9] Accordingly, the ethmoid labyrinth originates from cartilage; the frontal sinus, from membrane. When in their development tissues of different origin come together, tumor growth is liable to take place (Cohnheim). Obviously, this would put the pedicle in the area of the frontal ethmoid suture. In 3 of the cases presented here, in which the bony growth was operated on, the attachment was found to be at the outer and lateral area of the sinus, in a site far removed from the ethmoid bone.

Many writers have stressed the importance of trauma, but this is of doubtful value since there are few American youths who have not taken their share of blows on the forehead and the head. Finally, there is the theory of infection, that repeated infections of this sinus result in abnormal activity initiating tumor formation. In view of this theory it is noteworthy to relate that in 2 of my cases roentgen study revealed osteitis of the frontal bone for a small area lateral to and above the upper margin of the sinus. This was found surgically to have an appearance of osteitis and it was at this site that the true tumor mass was attached, which suggests the possibility of periosteal inflammatory processes being a strong factor in the causation of the growth. The periosteal theory could explain the importance and the stress which early writers placed on syphilis as the cause, which today is considered remote. In the final analysis the etiologic factors of osteoma are as obscure as those of other forms of neoplasm, and the remarks stated here are conjectures and theories, no one of which is applicable to every tumor established as osteoma.

PATHOLOGY

Osteoma is a benign tumor, the growth of which is usually very slow and which is malignant only mechanically. That is, to quote Gerber,[10] they are malignant because, by the capacity of enormous development and the situation in direct proximity to vital organs they menace the life of the host. Morphologically, two types are recognized; the hard, ivory-like, eburnated type and the softer, cancellous one. Microscopically, there may be great variations. Ewing [11] stated that at times it is difficult to differentiate certain forms of osteoma from simple hypertrophy of bone. On the other hand, he related the variations in the structure of tumors of this type. Some show solid lamellae with few or no haversian canals; others, cancellous structures with narrow cavities and spaces. In the series of cases presented here the tumor was a mixed type; that is, some areas were cancellous, others hard and eburnated.

SYMPTOMS AND DIAGNOSIS

The greater incidence of this lesion in the last few years is not in my opinion an indication that the tumor is more common but rather that there is a greater use of the roentgenogram. A perusal of the literature reveals that in many cases the diagnosis comes only by roentgen examination because of the silent nature of these growths. Dizziness, headaches and deformity are the cardinal symptoms. When

6. Malan, E.: Chirurgia degli osteom delle comtá pneumaticle perifacciali; contributo-anatomo clinice, Arch. ital. di chir. **48**:1 (Jan.) 1938.

7. Carmody, T. E.: Presentation of Instruments and Specimens, Arch. Otolaryng. **16**:290 (Aug.) 1932.

8. Arnold, J.: Zwei Osteome der Stirnhöble, Virchows Arch. f. path. Anat. **57**:145, 1873.

9. Gatewood, W. L., and Settel, N.: Osteoma of the Frontal Sinus, Arch. Otolaryng. **22**:154 (Aug.) 1935.

10. Gerber: Les osteomes dur sinus frontal, Ann. internat. de laryng. **23**:1, 1907.

11. Ewing, J.: Neoplastic Diseases, Philadelphia, W. B. Saunders Company, 1941.

mity is present, the diagnosis is rather ious; otherwise a diagnosis can rarely be de without the use of the roentgenogram.

The extension of the tumor mass may be in or in all of three directions, namely, exter- lly through the outer table, internally into the erior cranial fossa and, lastly, inferiorly into orbit. The symptoms, then, will depend on structure on which the pressure, due to the panse of growth, is being directed. If the ection of the growth is internal, the inner le is eroded and the lesion becomes intra- nial. Displacements of the dura and perfor- on may occur, with escape of cerebrospinal id into the nasal chamber. Infection may cur along the route established, causing men- itis or abscess of the brain. Cushing [12] re- ded 3 cases, one in which cerebrospinal rhinor- ea was present, due to communication with cerebral ventricle. In a second a large intra- ebral pneumatocele was revealed; in a third, arge intradural mucocele. When invasion of orbit occurs, unilateral nonpulsating exoph- lmos results, with the globe displaced down d out. There is no disturbance of visual acuity il late. However, diplopia is a common mptom. Later as the tumor enlarges, the optosis becomes so great that there is inabil- to close the lids, causing corneal ulceration. nally, pressure on the ophthalmic vessels and ves causes a sightless eye.

CAUSE AND PROGNOSIS

The prognosis in cases of osteoma of the ntal sinus is usually good. The tumor is ign and comparatively slow growing. With- operation the mortality is as high as 48 per t. due to complications, a statement made Beck [13] (1930) which has been unconfirmed. ce 1875 there have been 189 cases in which gical treatment was used, with death in 7— ortality of 3.7 per cent. The total mortality the whole group of surgical cases is 7.76 cent (Teed, 1941). It is my impression t these figures are now too high. With the dern methods of advanced surgery a figure ess than 1 per cent is not a possibility but a bability.

The course depends on the patient. Since the y cure is radical surgical extirpation, the sooner it is expedited, the sooner can one hope for relief. With a tumor small and asymptomatic, it is not impossible to understand and carefully observe the progress by repeated roentgen examinations. On the other hand, if the tumor involves the entire sinus with or without extrasinal involvement, surgical intervention should not be too long deferred.

TREATMENT

The only treatment for osteoma of the frontal sinus is surgical removal. Before this is attempted in the hospital at which I am stationed, certain procedures are followed which my associates and I feel are indispensable and add greatly to the success of the surgical procedure.

The diagnosis having been established and surgical removal planned, the case is thoroughly worked up from a general medical and laboratory point of view, including determination of a prothrombin index. The latter we think important since within the past few months we have seen 2 patients with a normal bleeding and clotting time for whom surgical treatment had been performed, only to be complicated within the first twenty-four hours by postoperative bleeding and hematoma formation, with its concomitant worry to the surgeon.

Before surgical treatment is instituted, we prefer to have our patients show a blood level of a sulfonamide compound of at least 10 mg. per hundred cubic centimeters. To accomplish this, we put the patient at semirest in bed three to five days prior to operation and begin the chemotherapy with a daily laboratory check on the blood and the urine. The day prior to operation 250 cc. of a 2.5 per cent solution of sulfadiazine in distilled water is given by vein. Immediately following the patient's return from the operating table, another 250 cc. of a 2.5 per cent solution of sulfadiazine and later 1,000 cc. of a sixth-molar solution of sodium lactate are given intravenously. The following day the chemotherapy is started orally and continued for a period of ten to fourteen days.

A point of interest is the incision. If the tumor involves the entire sinus and especially if there is extrasinal extension, the incision for the usual external operation on the frontal sinus is inadequate. This point is beautifully exhibited in 1 of the cases to be presented. Before the patient was transferred to this station a surgical attempt at removal by the external frontal method had been unsuccessfully attempted. This was due in our opinion to the inadequate exposure afforded by such an incision. We did not think such a radical incision as the inverted flap

2. Cushing, H.: Experiences with Orbital Ethmoidal eomata Having Intracranial Complications with ort of Four Cases, Surg., Gynec. & Obst. **44**:721 ne) 1927.

3. Beck, J. C.: Some Uncommon Types of Neo- ms About the Head, Tr. Am. Laryng., Rhin. & l. Soc. **36**:374, 1930; Laryngoscope **40**:511 (July) 0.

back of the hair line was indicated, and so we compromised on a horizontal incision of the forehead 1 to 1½ inches (2.5 to 4 cm.) above the brow. Since most operating otolaryngologists have had some basic training in plastic surgery and since the wound heals by primary intention, our results with this method have been excellent. The exposure at the time of operation is more than adequate and the resulting incision and scar line in a matter of a few months is not noticeable. Another procedure which we have followed is not to disturb the nasofrontal duct. So often an operator is tempted to pass a probe or a rasp into the nasofrontal duct. There is no infection in these cases (if there is, surgical treatment should have been deferred). Following the removal of the tumor mass, sulfanilamide crystals are dusted into the cavity, and it packed with iodoform gauze.

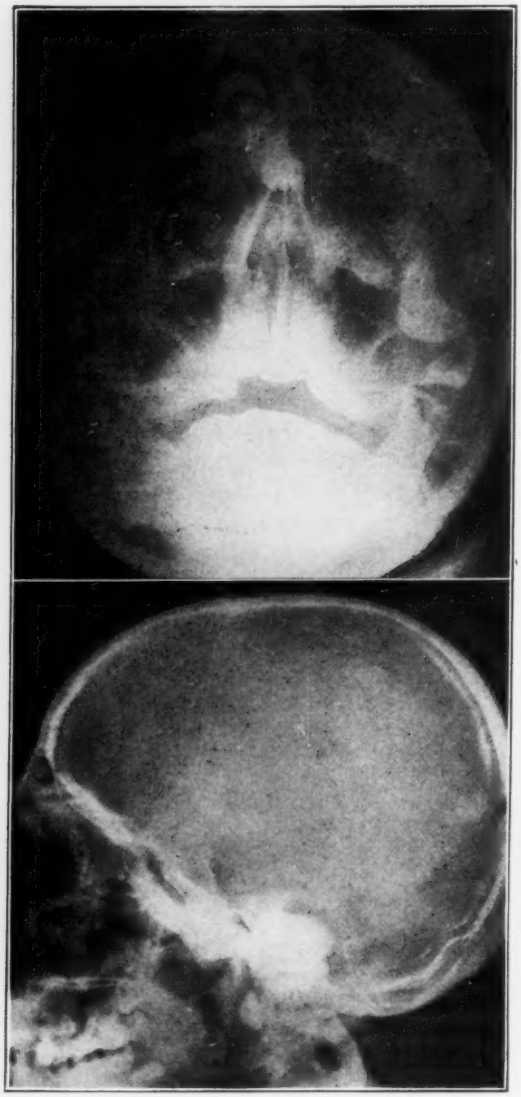


Fig. 1 (case 1).—Roentgenograms revealing the entire right frontal sinus completely filled by osteoma.

This packing is removed in seventy-two hou through the external incision. The rationale this method is to prevent the sinus cavity fr becoming filled with sanguinoserum follow operation, which is a most desirable cultu medium. Finally, I should like to add one mo point. I do not believe any surgical proced should be attempted on the frontal bone with

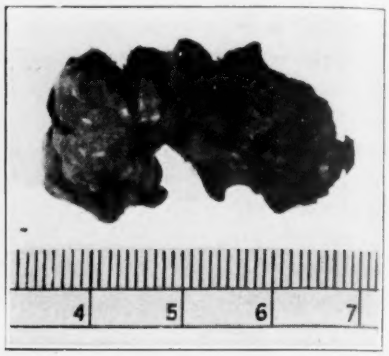


Fig. 2 (case 1).—Photograph of the gross oste removed. The measure is metric.

Fig. 3 (case 1).—Photograph taken two weeks af surgical intervention. Compare with figure 9.

a thorough knowledge of the anatomy and esp cially of the genesis of osteomyelitis of the fro tal bone. To this knowledge, no better refe ence can be had than to the contributions o work so ably contributed by Dr. Harris Mosher.

REPORT OF CASES

CASE 1.—G. G., a man 22 years old, white, born Germany (prisoner of war), was admitted to this ho pital on April 13, 1944. He stated that while in Trip North Africa, in May 1942, he had some trouble wi his teeth. At that time, one tooth was severely fected, and three teeth were removed. Following

cedure, he began to suffer from severe frontal head-
es on the right side. Roentgenograms taken at that
e revealed frontal sinusitis on the right side (patient's
cement), and it was decided, he stated, to wait six
nths after the dental work before surgical treatment
he sinus was considered. Subsequently he was trans-
ed to the United States. In September 1943 the
ht frontal sinus was opened by the classic external
te. The patient made an uneventful recovery from
surgical procedure but without relief from his head-
es. He was then transferred to this station on
il 13, 1944.

All laboratory tests showed conditions essentially normal. Serologic tests gave negative results. A complete blood count revealed 4,450,000 red cells, 6,950 white cells and a hemoglobin content of 95 per cent. The differential percentages for the white cells were neutrophils 53, lymphocytes 38, monocytes 5, eosinophils 2 and immature lymphocytes 2. Urinalysis gave negative results. The blood pressure was 128 systolic and 76 diastolic. The family and previous personal history were essentially irrelevant. A diagnosis of primary osteoma of the right frontal sinus was made, and on May 9 the patient was operated on (having previously been given sulfadiazine so that at the time of operation the blood level of this drug was 10 mg. per hundred cubic centimeters). At operation a small previous surgical dehiscence of the outer table of the right frontal sinus at its lateral edge was found. The tumor mass was removed in two pieces (fig. 2). The convalescence and recovery were uneventful.

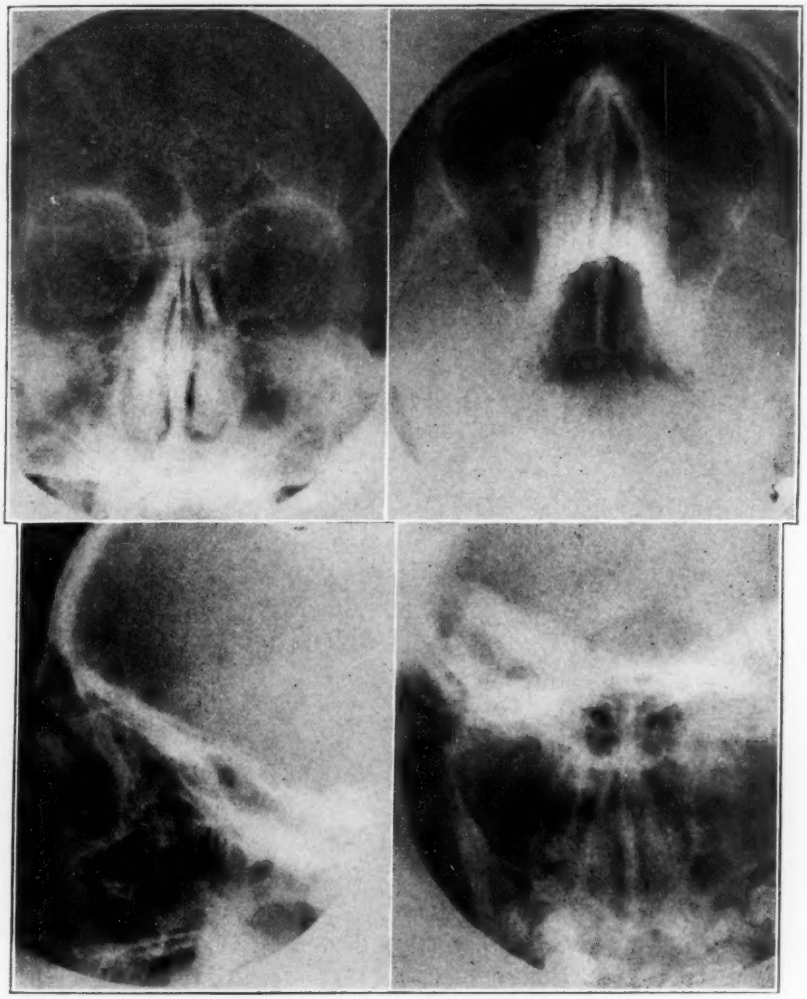


Fig. 4 (case 1).—Roentgenograms of the same patient after surgical removal of the osteoma of the right
tal sinus.

xamination at our clinic revealed a healed incision
right frontal external sinusotomy. The patient
plained of continued frontal headaches localized to
right side and over the right frontal area. There
no external deformity. A small bony defect due
previous surgical intervention could be felt digitally
he outer edge of the frontal sinus. Physical in-
tion revealed the nose to be essentially normal.
tonsils were present and did not show any disease.
larynx and the ears were normal. The sinuses on
illumination were clear except for the right frontal
s, which was dark. Roentgen studies revealed an
gular tumor mass filling the entire right frontal
s; it had the gross appearance of osteoma.

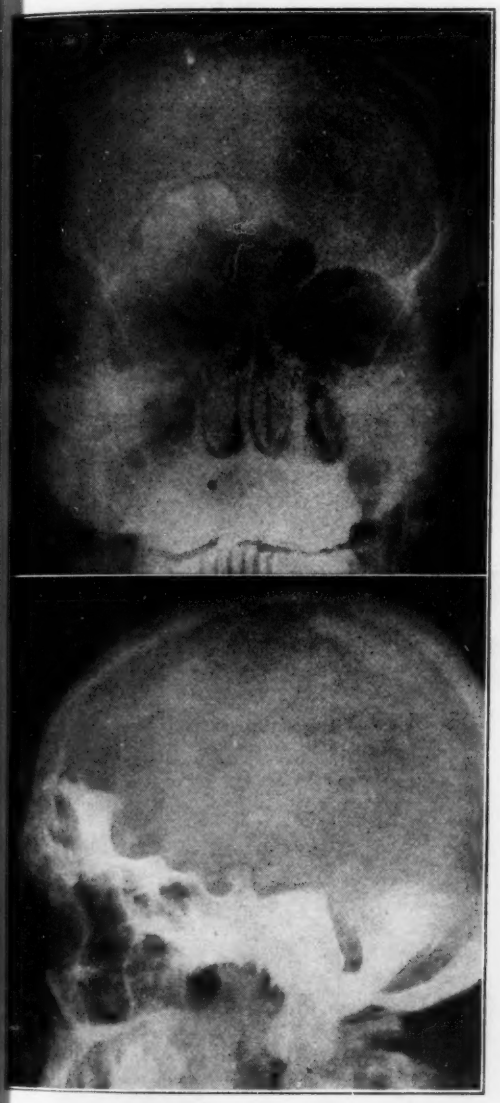
The patient was discharged from this hospital on June 15, free from all headaches, with the wound healed solidly (fig. 3). Roentgenograms made in a check of progress revealed the removal of the entire tumor mass (fig. 4). The patient is to return in three months for a recheck of his progress.

Pathologists' Report (Lt. Col. Paul Schmitt).—An irregular piece of bone, measuring 3.5 by 2 by 2 cm., was examined. One piece was compact, like ivory in character, while the other was cancellous. Microscopic examination showed the ivory-like portion to be composed of almost a solid sheet of laminated bone (fig. 5 *A*) in which were scattered a moderate number of haversian canals. The bone corpuscles were moderate in number and irregularly placed. The cancellous portion (fig. 5 *B*) showed a marked variation in size, the shape and the arrangement of the trabe Some of the trabeculae were laminated, while were smooth and homogeneous. Haversian canal

Fig. 5 (case 1).—*A*, osteoma: ivory or compact portion. Note almost solid sheet of bone with irregu placed haversian canals. *B*, osteoma: spongy portion. Note massive irregularity of the trabeculae lying dense vascular fibrous tissue.

scant, and the bone corpuscles were moderately nu ous.. The intratrabecular spaces were filled moderately vascular dense fibrous tissue. There little evidence of either osteoclastic or osteob activity. The diagnosis was osteoma.

ASE 2.—D. A., a white man, of 29 years, born in ois, was admitted to this hospital on Feb. 1, 1944, formal transfer from a station hospital. At the of admission he was ambulatory and afebrile but plained of headaches of a persistent nature over the frontal area. There was displacement of the left



ig. 6 (case 2).—Osteoma involving the entire frontal s with extension into the anterior cranial fossa orbit.

downward and outward, with a bony deformity er the upper left orbital ridge at the inner margin. history was carefully taken. The patient was in- ted into the service from a large midwest city seven nths previously. He stated that he had noticed head- e and deformity of the left eye for the past two years. family and previous personal history were essen- ly irrelevant.

xamination at this station revealed a well developed nourished man of some 29 years. All laboratory k gave essentially normal results; blood pressure 122 systolic and 70 diastolic; inspection of the showed it to be essentially normal; the tonsils e present and did not appear diseased; the larynx the ears were normal; the hearing acuity was normal bilaterally. A hard tumor mass could be felt at the inner margin of the orbit, just beneath the left upper orbital ridge, with concomitant displacement of the globe, downward and outward. Vertical diplopia was present. The visual acuity was, right, 20/15, left, 20/20, uncorrected. Other physical findings were essentially normal.

Roentgen examination revealed a large bony tumor mass occupying the entire left frontal sinus and eroding the inner table into the interior cranial fossa for a distance of some 33 mm. from the external table. It also extended into the left orbit (fig. 6).

A diagnosis of primary osteoma of the left frontal sinus extending into the left anterior cranial fossa and the left orbit was made. Since the lesion had been present for some time before the patient's induction into the army and his home was in a large metropolitan city, it was not believed to be the primary responsibility of the Army to perform the necessary operation. The patient was discharged on a certificate of honorable discharge.

CASE 3.—H. L., a white man aged 35, born in Germany (prisoner of war), was admitted to this hospital on June 6, 1944. On admission he was afebrile and ambulatory and did not appear acutely ill. He complained of intermittent frontal headaches and a feeling of pressure in the nose. He also complained of indefinite pains in his ears and throat.

His previous history revealed that on Aug. 26, 1943 he was hospitalized at another station with the following diagnoses: (1) acute enterocolitis, catarrhal, of undetermined cause; (2) psychoneurosis, hypochondriac in type, of a moderate nature. He was discharged on Sept. 9, 1943, with a note that the gastrointestinal lesion was cured and that the psychoneurosis was unchanged.

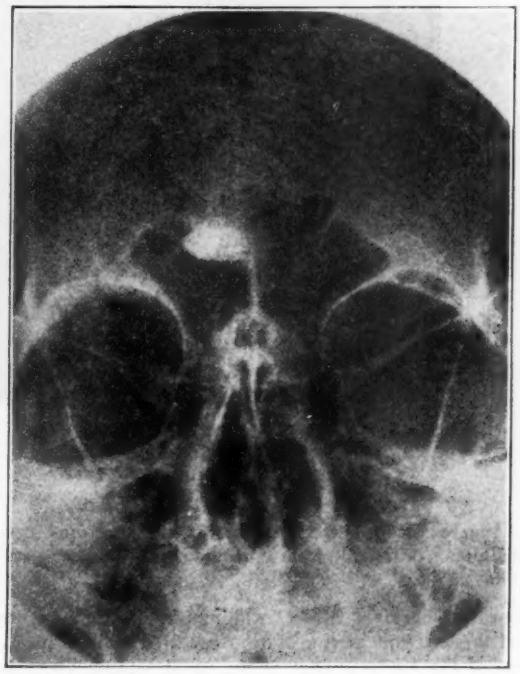


Fig. 7 (case 3).—Roentgenogram showing a small osteoma of the right frontal sinus.

On November 16 he was readmitted to the station hospital because of a feeling of pressure and a burning sensation on the top of his head. During the routine

examination it was found by roentgenogram that a small tumor mass was located in the left frontal sinus. He was subsequently transferred to this hospital on Jan 6, 1944.

Here the examination revealed a man well nourished and well developed. He complained of pressure over the forehead and the top of his head, of equal intensity on both sides. He also complained of vague and indefinite pains in both ears and the throat. He

on both sides. Roentgen examination of the sinuses a the paranasal sinuses revealed the presence of a s tumor mass in the left frontal sinus, measuring 1.5 1 cm. (fig. 7).

Physical examination revealed an adenomatous e largement of the right lobe of the thyroid gland ab the size of a lime. A fine tremor was present. T eyes had an unusual glassy stare. Successive ba metabolism tests gave the following records: +

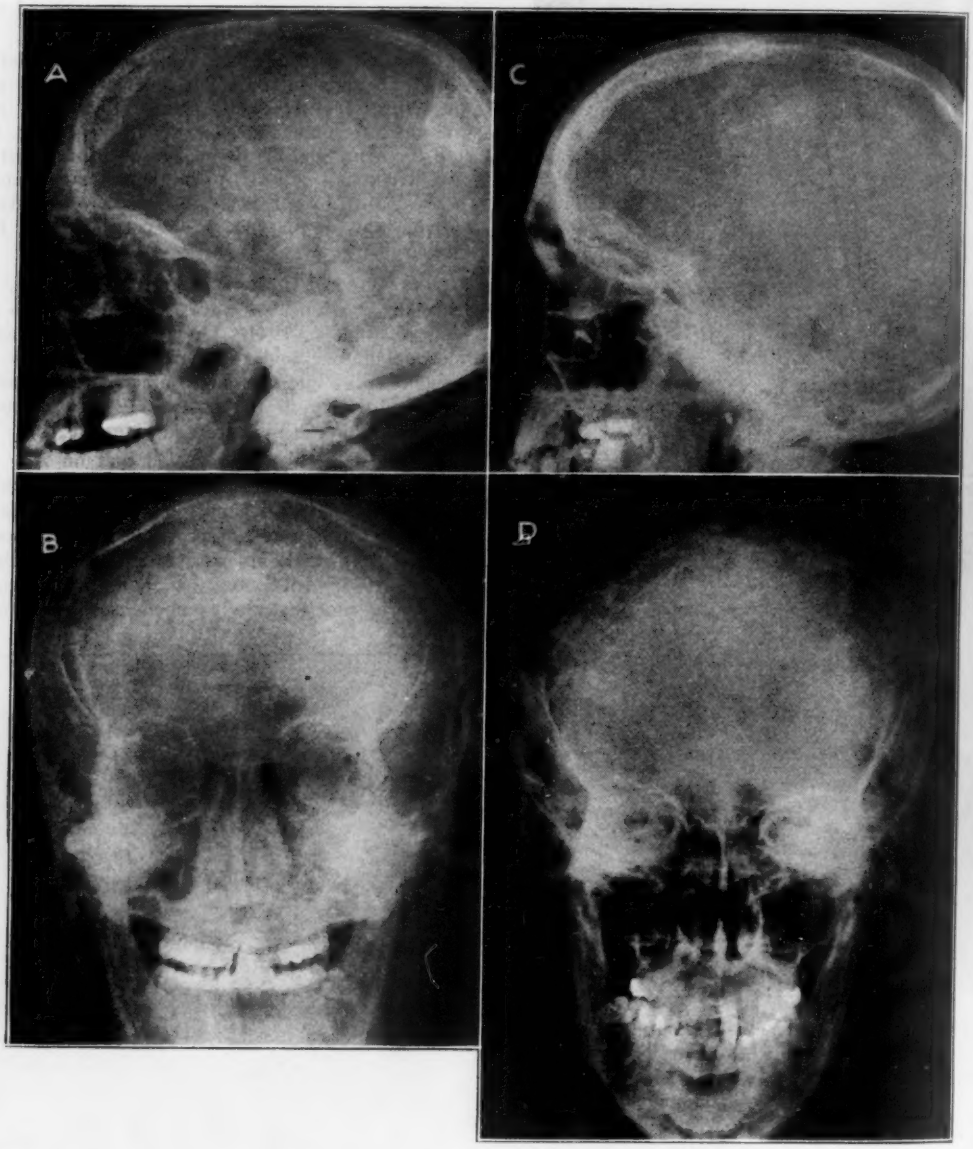


Fig. 8 (case 4).—*A* and *B*, roentgenograms revealing osteoma involving the right frontal sinus. *C* and roentgenograms taken after surgical removal of the osteoma of the right frontal sinus.

appeared nervous. The examination in the ear, nose and throat clinic at this station revealed a small perforation of the anterior part of the nasal septum (surgical), about 1 cm. in diameter. The sinuses on transillumination were clear; the tonsils were embedded and small and did not appear diseased; the larynx was normal; both ear drums were intact and normal in appearance; hearing for whispered voice was 15/15 in both ears. There was some tenderness to digital pressure over both frontal sinuses and over the vertex of the skull, equal

+ 18, + 11, + 10, + 6 per cent. The final one w unsatisfactory. These tests were taken at intervals several days. The medical service made a diagnosis mild hyperthyroidism.

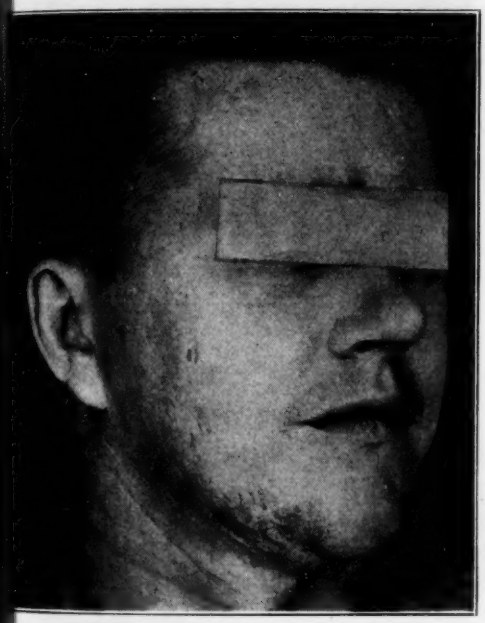
After full consideration of the previous history a all clinical data relevant to the case, it was decid because of the relatively small size of the tumor the left frontal sinus and the co-existing hyperthyroid that surgical intervention for the present should deferred and that the patient should be kept un

ical observation, with the progress of the tumor s being checked at intervals.

ASE 4.—E. P., a 30 year old white man born in o, was transferred from a station hospital to this ital with a diagnosis of osteoma of the right frontal s on Dec. 24, 1943.

he history reveals that this patient suffered from tal headaches, which began in August 1943 and h, he stated, had become gradually worse in intensity. consulted the dispensary at his previous station, and the work-up the roentgen examination revealed mor mass, probable osteoma, involving the entire t frontal sinus.

xamination here revealed a well nourished, well de- ped man of some 30 years, afebrile and ambulatory. complained of a dull frontal headache, which was lateralized. There was no deformity or tenderness the frontal sinuses. Physical inspection showed nose to be essentially normal. The right frontal s was dark on transillumination. The pharynx, larynx and the ears were normal. The hearing



g. 9 (case 4).—Photograph taken five months after ical intervention. Note the well healed and in- picuous incisional scar.

whispered voice was 15/15 bilaterally. Roentgen ination was reported as follows: "The outline of right frontal sinus is obliterated by an irregular ase in density which almost completely fills the . This density in the lateral view has a round arance and is encroaching on the sinus cavity, ucing slight erosion of the sinus walls anteriorly posteriorly. At the lateral margin of the sinus appears a small area of sclerotic reaction, which be interpreted as osteitis. The skull shows no icant alteration." The diagnosis was osteoma of the frontal sinus and osteitis of the frontal bone.

laboratory examinations gave normal results. A ac murmur was noted, which our cardiologist osed as indicative of a nonorganic cardiorespiratory . Serologic tests gave negative results.

Jan. 27, 1944, with the patient under general hesia, the tumor was surgically removed. At operation the walls of the sinus were found to be intact. The area of osteitis was also resected.

Convalescence and recovery were uneventful. Subsequent examination at the end of five months revealed the patient to have a well healed, solid incisional scar (fig. 9), and he had been free from all headaches since surgical removal of his tumor. Roentgenograms made in a check of progress showed that there had been no recurrence of the osteitis.

CASE 5.—C. M., an air cadet, 21 years old, white, born in West Virginia, had suffered from recurrent sinus

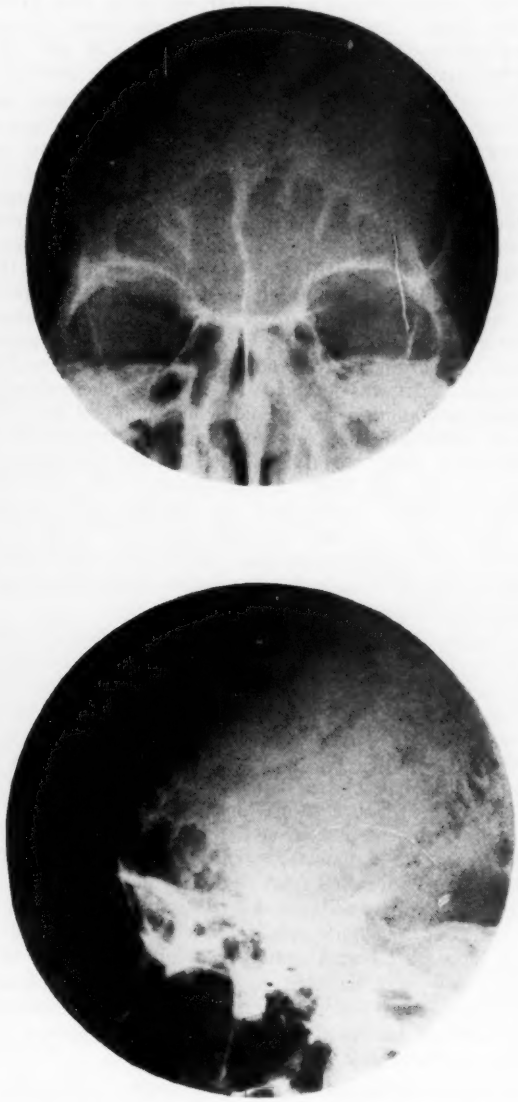


Fig. 10 (case 5).—Roentgenograms revealing diffuse suppurative frontal sinusitis, bilateral, with osteitis of the floor of the left upper cell and a small tumor considered to be osteoma.

infections, characterized by headache, since childhood. After induction into the Army he was hospitalized frequently for the same trouble. At his previous station partial bilateral ethmoidectomy was performed, with removal of nasal polyps. There was no improvement in the profuse nasal discharge and the headaches. It was recommended that he be transferred to a general hospital for further observation and treatment.

He was admitted to this hospital June 22, 1944. He was afebrile and ambulatory. He did not appear ill but complained of a dull frontal headache, which was not lateralized, and of a continuous feeling of pressure in his head. He also complained of a profuse purulent nasal discharge and stated that he had suffered from sinusitis for many years but that since flying his symptoms had become worse.

Examination revealed a well nourished and developed man of 21 years. No evidence of physical or organic disease other than that involving the head was found. The blood pressure was 116 systolic and 76 diastolic. Blood counts revealed 4,150,000 red cells and 11,050 white cells. The differential leukocyte count showed neutrophils 62 per cent and lymphocytes 38 per cent. Urinalysis and serologic tests gave negative results.

Examination of the nose revealed thick creamy pus in the left, middle meatus with small multiple polypi bilaterally. The tonsils were absent. The larynx and the ears were normal. The left frontal sinus and the left antrum on transillumination were dark. Roentgen examination revealed pansinusitis of the left side with bony changes at the superior margin of the left frontal sinus, possibly osteitis or osteomyelitis (fig. 10). Diagnostic lavage of the left antrum returned a copious amount of well organized thick creamy exudate. Culture revealed a mixed infection of gram-negative bacilli and gram-positive cocci; the latter were penicillin sensitive. It was decided to institute chemotherapy immediately, both a sulfanamide compound and penicillin being administered. A neurologic consultation and a spinal tap gave negative results. After five days of rest in bed and daily antral lavage, with penicillin being instilled locally into the antrum, the antrum washed clear. It was felt that with the blood level of the sulfonamide compound at 15 mg. per hundred cubic centimeters radical investigation of the left frontal sinus should be done.

On July 7, 1944, with the patient under intratracheal anesthesia, a radical surgical procedure was performed through an incision in the forehead. The anterior wall of the left frontal sinus was found to be so thin as to be practically transparent in part. When the anterior wall was removed, the sinus was seen to be filled with chronically hyperplastic membrane, and in the center of the sinus was a pocket of thick creamy pus. Material was taken for culture, and the diseased tissue was removed. On exploration of the upper limits of the sinus, a smaller cell was found which was free of the pathologic conditions described but which showed in its floor a definite osteitic process and, attached to this, a small rounded tumor mass about the size of a pea. This was believed to be a small osteoma and was removed. The postoperative course was uneventful, and up to the time of writing convalescence has been satisfactory.

This case illustrates a dual pathologic process within the confines of a frontal sinus, with the main body of the sinus showing a suppurative process with concomitant thickening of the membrane and the smaller suprasinal cell revealing relatively no change in the lining membrane but definite osteitis of the floor, to which a small osteoma is attached by a pedicle.

SUMMARY

Primary osteoma of the frontal sinus is not a common lesion. The majority of case reports are European. The fact that 2 of the 5 patients whose cases are herewith presented were from Europe (prisoners of war), raises the ques whether or not osteoma is more or less end to the European continent. The etiology is obscure; however, the presence of co-exis osteitis in 2 of the cases seems to lend plausibility and weight to the periosteal the The recorded mortality rate in the opera cases is far too high; it is my belief tha mortality rate of less than 1 per cent with present application of modern and adva

Fig. 11 (case 5).—Roentgenograms taken after r operation on the left frontal sinus and resection removal of the osteoma.

surgical technic is not a wishful dream l reality. The method of surgical attack suc fully employed here is submitted. In 2 of 5 cases of primary osteoma of the frontal s reported, the sinus was not operated on, in 3 the osteoma was removed, with uneve recovery on the part of the patient.

PENICILLIN IN ACUTE OTITIS MEDIA AND MASTOIDITIS

A REPORT OF CASES

COMMANDER SIMON BALL (MC), U.S.N.R.

Since the observation of Fleming,[1] in 1929, that growth of certain bacteria in cultures is inted by the introduction of a mold, many cles have appeared in the literature on the tment of infectious processes with penicillin. naval hospital within the continental limits e was afforded an opportunity of evaluating efficacy of this treatment in otolaryngologic ases, particularly in regard to the effect on urative otitis media and complicating mastitis.

ecause of the difficulties in obtaining sufnt quantities of the drug, most of the experital work with penicillin in otolaryngologic ases was limited to local use. Investigators [2] e used this drug after mastoidectomy, instillit through a small rubber drainage tube after ost completely closing the postauricular inon.

he patients whose cases are reported in this er were all treated with a sulfonamide comnd, and penicillin was administered only r the infection had been demonstrated to be stant to sulfonamide drugs. Twelve patients acute suppurative otitis media complicating let fever, and 5 with nonscarlatinal otitis ia complicated by mastoiditis were available this study. To each sulfadiazine was adistered in accordance with accepted dosage btain a maximum blood level. All were so ted for a period of from one to three weeks. en, after this interval, no improvement was d, or when the suppurative process became gressively worse, chemotherapy was stopped the administration of penicillin begun.

The diagnosis of acute otitis media and acute mastoiditis was established on otologic and roentgenologic evidence. Otologically all the patients were shown to have a thick, purulent, malodorous exudate, sagging of the superior-posterior wall of the external canal and occasional granulations presenting through a perforation in the tympanic membrane. These findings, with or without postauricular edema and redness, accompanied by pain and tenderness over the tip of the process, the mastoid antrum or the emissary vein were considered adequate for the clinical diagnosis of acute surgical mastoiditis. Roentgenologically, cellular edema, clouding and loss of intercellular septums were demonstrable.

OTITIS MEDIA COMPLICATING SCARLET FEVER

Of the 12 cases of acute otitis media complicating scarlet fever, 1 required surgical intervention. In 10 of the cases the otitis rapidly responded to treatment. In 1 case recovery occurred slowly—which was attributed to the fact that the pathologic condition resembled an acute exacerbation of chronic recurrent suppurative otitis media. Material from the middle ears in these cases yielded on culture a growth predominantly of Streptococcus haemolyticus. Penicillin was administered by the intramuscular route in all cases; each dose was 20,000 Oxford units, and the doses were given at four hour intervals, day and night. The 10 cases in which response to treatment was rapid showed resolution of the involvement of the tympanic membrane and restoration of normal hearing in from one to two weeks (average time nine days). Individual reports of these cases follow:

CASE 1.—A. J., aged 19, was admitted to the hospital on Feb. 25, 1944 with a diagnosis of scarlet fever. On the following day the right tympanic membrane perforated spontaneously. The sedimentation rate was 23.0 mm.; the white blood cell count was 8,900, with 78 per cent neutrophils, and the hemoglobin content was 91 per cent. Roentgen studies prior to the administration of penicillin showed slight clouding of cells in the mastoid on the right.

Sulfadiazine was given orally, totaling 48 Gm. in fourteen days. Routine local treatment was given to ear, nose and throat. The suppuration became more

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The opinion or assertions contained herein are the ate ones of the writer and are not to be construed fficial or reflecting the views of the Navy Depart- or the naval service at large.

1. Fleming, A.: On Antibacterial Action of Cultures Penicillin, with Special References to Their Use in ation of Bacillus Influenzae, Brit. J. Exper. Path. 226-236 (June) 1929.

2. Florey, M. E., and Florey, H. W.: General and al Administration of Penicillin, Lancet **1**:387-397 arch 27) 1943. Bordley, J. E., and others: Local of Sulfonamides, Gramicidin, Tyrothricin and icillin in Otolaryngology, Ann. Otol., Rhin. & ng. **51**:936-944 (Dec.) 1942.

profuse, and tenderness of the mastoid tip developed. Administration of penicillin was begun on the fifteenth day of treatment. Five days later all suppuration had ceased, the involvement of the tympanic membrane was completely resolved, and the acuity of hearing was normal. The treatment with penicillin was continued for six additional days, so that this patient received a total of 1,550,000 Oxford units.

CASE 2.—A. R., aged 21, was admitted to the hospital on Feb. 8, 1944 with a diagnosis of scarlet fever. Ten days later the right ear showed a bulging red tympanic membrane, and myringotomy was performed. The suppuration increased despite the administration of a total of 96 Gm. of sulfadiazine in a period of seventeen days. The sedimentation rate was 15.0 mm.; the white blood cell count was 7,250, with 69 per cent neutrophils, and there was a hemoglobin content of 91 per cent. Roentgen studies prior to penicillin therapy showed clouding and loss of cellular detail throughout the right mastoid process.

The administration of penicillin was begun on the seventeenth day of treatment. After seven days otorrhea had ceased. Two days later the tympanic membrane was well healed and the acuity of hearing was normal; so treatment with penicillin was discontinued after the administration of a total of 1,880,000 Oxford units.

CASE 3.—B. H., aged 45, was admitted on March 21, 1944 with a diagnosis of scarlet fever and suppuration of the middle ear. Examination disclosed congestion of the tympanic membrane with a medium-sized perforation and a profuse purulent exudate. The sedimentation rate was 24.0 mm.; the white blood cell count was 13,700, with 81 per cent neutrophils, and the hemoglobin content was 89 per cent. No roentgen studies were deemed necessary.

After ten days of treatment with sulfadiazine (total dose, 60 Gm.) the otorrhea had increased; so penicillin therapy was begun. This treatment could be discontinued seven days later, since the tympanic membrane was well healed and the acuity of hearing was restored to normal. The total quantity of penicillin administered was 860,000 Oxford units.

CASE 5.—C. U., aged 18, was admitted with a diagnosis of scarlet fever on Feb. 28, 1944. Examination revealed a bulging red tympanic membrane, necessitating incision and drainage. The sedimentation rate was 23.0 mm.; the white blood cell count was 13,900, with 82 per cent neutrophils, and the hemoglobin content was 71 per cent. Roentgen examination disclosed clouding and thickening of all cells in the left mastoid process.

The discharge continued, becoming more profuse despite the administration of a total of 46 Gm. of sulfadiazine over a period of ten days. After six days of treatment with penicillin the aural discharge had ceased. Four more days of treatment left the tympanic membrane entirely healed and the acuity of hearing markedly improved. The total amount of penicillin administered was 1,890,000 Oxford units.

CASE 6.—H. W., aged 18, was admitted on Jan. 19, 1944 with a diagnosis of scarlet fever. He gave a history of recurrent attacks of suppurative otitis media on the left side over a period of ten years. Three days after admission the left ear drained spontaneously. Examination disclosed a large irregular perforation in Shrapnell's membrane with malodorous, thick, purulent exudate. There was marked loss of hearing. The sedimentation rate was 16.0 mm.; the white blood cell count was 8,300 with 64 per cent neutrophils, and the hemoglobin content was 94 per cent. Roentgen examination revealed a chronic involvement of a sclerotic left mastoid process.

There was no improvement in the condition of the left ear after intermittent administration of 156.0 Gm. of sulfadiazine over a period of forty-four days. Twenty-one days after institution of penicillin therapy all discharge from the left ear had ceased, but the perforation remained. Treatment with penicillin was stopped at this time after the administration of a total of 2,850,000 Oxford units.

CASE 7.—L. R., aged 24, was admitted with a diagnosis of scarlet fever on Feb. 14, 1944. Six days later spontaneous perforation of the left tympanic membrane occurred. Examination showed a medium-sized perforation in the posterior-inferior quadrant with profuse suppuration and visible pulsation. The hearing was moderately impaired. The sedimentation rate was 21.0 mm.; the white blood cell count was 12,000, with 83 per cent neutrophils, and the hemoglobin content was 87 per cent. Roentgen examination showed slight clouding of all cells of the left mastoid process.

Improvement had not occurred after the administration of a total of 24.0 Gm. of sulfadiazine over a period of twelve days. Penicillin therapy was begun and after seven days the discharge had entirely ceased. After seven additional days of therapy the tympanic membrane was found to be well healed and the acuity of hearing restored to normal. The total amount of penicillin administered was 1,850,000 Oxford units.

CASE 8.—M. J., aged 25, was admitted on Feb. 20, 1944 with a diagnosis of scarlet fever. Sixteen days later spontaneous perforation of both tympanic membranes had occurred. Examination showed small perforations of the tympanic membranes with profuse thick discharge, more pronounced on the right. There were postauricular edema and tenderness on the left. The body temperature was 102 F. The hearing was slightly impaired in both ears. The sedimentation rate was 18.0 mm.; the white cell count was 14,000 with 80 per cent neutrophils, and the hemoglobin content was 82 per cent. Roentgen examination showed thickening of all cells in both mastoid processes.

After five days of treatment with sulfadiazine (total dose, 58.0 Gm.), the discharge continued unabated, and the hearing loss became more pronounced. Penicillin therapy was instituted, and after five days all discharge from both ears had ceased, but small perforations were still visible. Eight more days of penicillin therapy found both drum membranes well healed and the hearing restored to normal in each ear. The total amount of penicillin administered was 1,740,000 Oxford units.

CASE 9.—M. T., aged 25, was admitted on March 9, 1944 with a diagnosis of scarlet fever. One day after admission he complained of a sharp pain in his right ear. The right tympanic membrane was found to be markedly injected and bulging. Myringotomy was performed. The sedimentation rate was 24.0 mm.; the white blood cell count was 16,400, with 74 per cent neutrophils, and the hemoglobin content was 85 per cent. Roentgen examination showed cloudiness of all cells of the right mastoid process.

No improvement resulting from twelve days of therapy with 45.0 Gm. of sulfadiazine, this patient was placed under treatment with penicillin. Fourteen days later all discharge from the ear had ceased, and the tympanic membrane was well healed. The total amount of penicillin administered was 1,680,000 Oxford units.

CASE 10.—S. E., aged 19, was admitted on Feb. 23, 1944 with a diagnosis of scarlet fever. Six

later pain developed in both his ears. Both tym- membranes were inflamed and bulging. Bilateral ingotomy was performed. The sedimentation rate 19.0 mm.; the white blood cell count was 21,000, 84 per cent neutrophils, and the hemoglobin con- was 90 per cent. Roentgen examination showed t clouding of both mastoid processes.

he discharge continued to be profuse despite the inistration of 32.0 Gm. of sulfadiazine over a period even days. Penicillin therapy was begun, and after n days all discharge had ceased. After fifteen days herapy, during which a total of 1,590,000 Oxford of penicillin had been administered, both tympanic branes were well healed.

ASE 11.—B. E., aged 19, was admitted on l 16, 1944 with a diagnosis of scarlet fever. Two s after admission a spontaneous perforation of the tympanic membrane developed. Examination re- d a medium-sized perforation in the anterior- rior quadrant with pulsation and a moderate amount ischarge. Two days later, tenderness over the oid tip was evident; the discharge became more se, and there was slight narrowing of the external tory canal. The sedimentation rate was 25.0 mm.; white blood cell count was 12,000, with 72 per cent rophils, and the hemoglobin content was 81 per Roentgen examination revealed clouding of all of the right mastoid process.

improvement was evident after the administra- of a total of 36.0 Gm. of sulfadiazine over a d of six days. At this time the body temperature reached 101 F., the discharge became more pro- ced, and postauricular tenderness and pain were nt. After two days of penicillin therapy the body erature was normal, the tenderness over the mas- process had disappeared, and the discharge had ned. Four more days were required for the dis- e to cease and the tympanic membrane to heal. total dose of penicillin was 640,000 Oxford units.

ASE 12.—L. J., aged 24, was admitted on Feb. 944 with a diagnosis of scarlet fever. This patient a history of having undergone mastoidectomy on right ten years prior to the present admission. in two days the left tympanic membrane had per- d spontaneously. Examination revealed a medium- central perforation with a moderate amount of anguinous exudate. A postauricular scar on the evidenced the previous mastoidectomy at this site. right tympanic membrane was without abnormality. sedimentation rate was 19.0 mm.; the white blood count was 12,400, with 88 per cent neutrophils, he hemoglobin content was 78 per cent. Roentgen ination showed edema and clouding of all cells of eft mastoid process and an operative defect of the mastoid process.

re being no improvement after the administration .0 Gm. of sulfadiazine over a period of nine days, illin therapy was begun. No improvement was nt, and eighteen days after the beginning of treat- with penicillin, headache, nausea, vomiting and o suddenly intervened. A neurologic consultant re- d evidence of acute left labyrinthitis. Mastoidectomy performed the following day, and marked cellular uction with pus and granulations was encountered. n last observed, two weeks after surgical inter- on, this patient still presented symptoms of slight inthine irritation. The total amount of penicillin istered was 2,000,000 Oxford units, given over a d of twelve days.

NONSCARLATINAL OTITIS MEDIA COMPLICATED BY MASTOIDITIS

Five cases of acute nonscarlatinal otitis media complicated by mastoiditis were studied. Each patient had been under treatment with a sulfonamide compound and was given penicillin only after signs and symptoms of complicating acute mastoiditis had developed. Material from the middle ear was reported as yielding on culture hemolytic Staphylococcus albus in 4 of these cases and hemolytic Staphylococcus aureus in 1. Cessation of aural suppuration, abatement of all subjective signs and symptoms, and complete resolution of the process in the tympanic membrane were accomplished in from three to eighteen days without the necessity of surgical intervention. Reports of the cases follow:

CASE 1.—N. C., aged 30, was admitted on March 28, 1944 with a diagnosis of acute suppurative otitis media of the right ear. Two weeks before, spontaneous perforation had occurred, followed by a profuse discharge. Examination revealed sagging of the posterior-superior wall of the external canal with narrowing of the canal, a thick purulent exudate and visible pulsation through a pinpoint perforation in the superior quadrant. There was bulging of the tympanic membrane, also tenderness of the mastoid tip and antrum. Myringotomy was performed on the following day. The sedimentation rate was 17 mm.; the white blood cell count was 14,200, with 88 per cent neutrophils; the hemoglobin content was 90 per cent. A roentgenogram showed generalized clouding of all cells of the mastoid process and evidence of early involvement of bone.

There was no response to 82.0 Gm. of sulfadiazine administered over a period of thirteen days. Penicillin therapy was begun, and after four days, during which time 460,000 Oxford units was administered, the discharge completely resolved. Observation after three weeks showed restoration of the normal structure of the tympanic membrane and normal acuity of hearing.

CASE 2.—F. D., aged 36, was admitted on March 17, 1944 with a diagnosis of acute suppurative otitis media of the right ear. The onset occurred three weeks prior to admission, at which time myringotomy had been performed. Examination revealed a medium-sized perforation of the posterior-inferior quadrant with a profuse thick purulent exudate, sagging of the posterior-superior wall of the external canal and postauricular pain and tenderness. The body temperature was 101. The sedimentation rate was 21.0 mm.; the white blood cell count was 11,000, with 62 per cent neutrophils, and the hemoglobin content was 84 per cent. A roentgenogram showed clouding throughout the right mastoid process with indistinct cellular outlines.

In spite of treatment with 62.0 Gm. of sulfadiazine, intermittently administered over a period of twenty-one days, all signs and symptoms continued unabated. Penicillin therapy was begun, and after four days, during which a total of 380,000 Oxford units was given, all discharge had ceased, the perforation of the tympanic membrane had resolved, and pain and tenderness were no longer evident.

CASE. 3.—A. W., aged 22, was admitted on March 8, 1944 with a diagnosis of acute suppurative otitis media of the right ear. The onset had occurred one week before admission, with spontaneous perfora-

tion. Examination disclosed a medium-sized perforation of the posterior-inferior quadrant with a profuse malodorous discharge and postauricular pain and tenderness. There was sagging of the posterior-superior wall of the external canal. The sedimentation rate was 16.0 mm.; the white blood cell count was 18,000, with 76 per cent neutrophils, and the hemoglobin content was 84 per cent. Roentgen examination showed clouding of all cells of the right mastoid process.

There was progressive improvement under treatment with sulfadiazine for a period of two weeks. At this time, after the administration of a total of 72.0 Gm. of the sulfonamide compound, a sudden recrudescence of all signs and symptoms developed. Penicillin therapy was begun, and after four days all discharge had ceased, and pain and tenderness had disappeared. Treatment was discontinued after seven days, a total of 860,000 Oxford units of penicillin having been administered. The involvement of the tympanic membrane had undergone complete resolution.

CASE 4.—L. W., aged 20, was admitted on March 18, 1944 with a diagnosis of acute suppurative otitis media of the left ear. Spontaneous perforation of the tympanic membrane had occurred one week prior to this. Examination revealed a medium-sized perforation in the posterior-inferior quadrant with visible pulsation and a profuse thick discharge. Postauricular edema and redness with tenderness over the left mastoid tip and antrum developed one week later. The sedimentation rate was 16.0 mm.; the white blood cell count was 9,000 with 75 per cent neutrophils, and there was a hemoglobin content of 79 per cent. Roentgenologic examination showed clouding and thickening of the walls of the cells of the left mastoid process.

As there was no improvement after the administration of 66.0 Gm. of sulfadiazine over a period of fourteen days, penicillin therapy was instituted. Over a period of eighteen days 2,000,000 Oxford units of penicillin was administered, with alternate remission and recrudescence. By the end of this period the ear was dry and the perforation completely healed, although the tympanic membrane appeared thickened and retracted. acuity of hearing had not been impaired.

CASE 5.—M. J. aged 38, was admitted April 21, 1944 with a diagnosis of acute suppurative media of the left ear. The onset occurred four days to admission with spontaneous perforation of the panic membrane. Examination showed a fairly central perforation with marked narrowing of external canal and sagging of the posterior-sup wall of the canal. There was tenderness over the toid tip and antrum. The sedimentation rate was mm.; the white blood cell count was 11,300, wit per cent neutrophils, and the hemoglobin content wa per cent. Roentgen examination showed clouding o cells and early cellular breakdown in the left ma process.

Forty-two grams of sulfadiazine given over a pe of fifteen days had brought no improvement; so t ment with penicillin was begun. After four day treatment with a total of 480,000 Oxford units, all and symptoms of mastoid involvement had disappe The tympanic membrane was well healed.

COMMENT

This series of cases is by far too small justify any definite conclusion. However, prompt response of acute scarlatinal suppura otitis media with complete restoration and p ervation of hearing deserves to be called to attention of physicians. Furthermore, the pro resolution and healing of acute nonscarlat suppurative otitis media complicated by m toiditis, without the necessity of surgical in vention, is most promising. As the supply penicillin becomes more plentiful, it should come possible for physicians generally to m use of this drug in the early treatment of t conditions.

MÉNIÈRE'S DISEASE

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LOS ANGELES

recent years, particularly in the past decade, has been much research regarding the syne first described by Ménière. There is a ency to introduce symptom complexes other Ménière's syndrome into these studies. ière's disease as defined in the original paper chain of disturbances, sudden in onset, in rwise healthy ears, causing nausea, vomiting, of equilibrium, nystagmus and total or partial of hearing affecting one or both parts of the nal ear. It is significant that the vestibular cochlear functions are damaged simulously and that frequently both ears are afd at the same time.

he organ of Corti and the surrounding struc- appear to obtain nutrition from three dift sources. Arterial twigs pass with the lear branch of the auditory nerve and trav- the foramens in the spiral lamina alongside outgoing nerve fibers, to join with several ies which run around the inside of the lea. The largest of these vessels is found in scala media. Minute branches pass from to the hair and adjacent cells. The outer of the scala media is highly vascular, a net- of capillaries lying under the epithelium. probable that oxygen and food pass by difn into the endolymph through the epithelium, that waste products are removed the same

Perilymph secreted in the utricle and the le passes up the scala vestibuli to the top e cochlea and then through a minute pore the helicotrema into the scala tympani be-

The vasomotor nerves originate in the ior, middle and inferior cervical ganglions. fibers to these ganglions leave by the first thoracic nerves, pass into the sympathetic through the stellate ganglions and the ansa eussens to the inferior cervical ganglion and e cervical sympathetic chain to the superior al ganglion. Here they end, and the im- s are carried by a fresh relay from cells in anglion, traveling by nonmedullated fibers e carotid arteries and its branches. The of these arteries is controlled by two sets of nerves, one set vasoconstrictor or motor, which will increase the state of constriction of the vessels, and the other set inhibitor or vasodilator, which diminish the tone of the arteriolar muscle and cause vasodilatation. Stimulation of the vasoconstrictor fibers by drugs, such as nicotine, extract of posterior lobe of the pituitary or epinephrine, or by a disease affecting the ganglions or fibers leading from them causes a rise in blood pressure within the arteries of the area supplied or if the vasoconstrictor fibers are functioning and their antagonists the dilators are not, a vasoconstriction occurs. The reverse is true if local metabolites gain control. There is a marked drop in blood pressure, with the blood rushing through the vessels so fast that it does not lose its oxygen. The venous return from an area such as that just described is highly oxygenated.

This normal chemical control of the circulation is carried out by two opposing groups of substances, the one acting as constrictors, the other as dilators. The constrictors are the active principle or principles present in the posterior lobe of the pituitary gland, which constitute the constant tonic constrictor, and epinephrine, which acts rapidly and intensely as an emergency measure. The second class of substances are produced in the tissues and typified in histamine. These substances are the products of the normal metabolism which dilate the minute vessels and thus direct the blood preferentially to those parts where metabolism is most active. The second mechanism is the more powerful, and when the two come into conflict the local metabolite tends to dominate the situation. The complete reaction produced by these histamine-like substances is threefold (Lewis' triple response): (1) a primary and local dilation of the minute vessels, (2) a local increase in permeability of the capillary walls and (3) a widespread dilatation of neighboring arterioles brought about by a local nervous reflex.

Epinephrine by its vasoconstrictor action may empty the arterioles and finally the veins of blood; a posterior pituitary extract constricts the arterioles and capillaries. Histamine constricts the arterioles and dilates the capillaries and increases their permeability maximally. The per-

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meability of the endothelium is a specific quality, but the capillary permeability is greatly increased by histamine and other metabolites.

A disturbance of the chemical or nervous control of the auditory artery causes Ménière's disease. Ménière noted in his autopsy that there was a hemorrhage into the labyrinth. This was partly true, as in severe vasospasm there is a following vasodilatation with marked hyperemia, and if there is a diffusion system communicating with the endolymph it is probable that the endolymph becomes discolored by bloody serum entering through this system. On the degree and the length of the spasm or the vasodilatation depends the damage to the tissues of the internal ear. A blanching of the area would cause sufficient trophic disturbances to destroy a part or all of the nerve endings. As this one artery supplies both the organ of equilibrium and that of hearing, they would be both affected simultaneously. In a similar condition, affecting much less sensitive tissue, Raynaud's disease, there is occasionally gangrene of the extremities. Thrombi appear in the area, causing necrosis. The view that exaggerated vasospasm is due to a fault of the central mechanism and not to a peripheral lesion as many think Ménière's disease to be is strongly supported by postoperative observations. Dr. J. W. Budd in an examination of the superior cervical ganglions in the case of Ménière's disease to be reported by us demonstrated definite pathologic changes.

The effect of the autonomic nervous system on peripheral circulation has been studied closely in the past few years. It is known that man is freely supplied with vasoconstrictor pathways. A blockage of these pathways such as that caused by injection of procaine hydrochloride inhibits constriction peripherally; by a reverse process, stimulating vasodilatation with heat inhibits vasoconstriction. These pathways are the conduits that carry the impulses to control the reactions of the periphery to various stimuli such as heat, cold, chemical irritants and the reflexes that result in blanching and blushing in response to emotional irritants. As stated, the vasoconstrictor fibers respond to stimulants. These may be of many types. Chemical irritants, foreign proteins, emotional disturbances, all could have the same effect if they irritated the vasoconstrictor fibers to the auditory artery.

The object of sympathectomy is to equalize the flow of blood to the internal ear. A patient with Ménière's disease usually follows a regular pattern; he has repeated attacks causing progressive loss of hearing.

There are four probable causes of Ménière disease: First there may be excessively str impulses passing along the sympathetic ner due to pathologic changes in the sympath nervous system itself. Second there may be excess of vasoconstrictor substances in the blo Third there may be an excess of histamine histamine-like metabolites in the local area a fourth, a hypersensitivity of the local area metabolites, allergens or the hormones mentio This condition is similar to Raynaud's dise angina, endarteritis, migraine and pylorospa It is possible that other conditions in the head caused by vasomotor disturbances. Rhinitis s is a vasomotor disturbance. The punched- peptic ulcer is probably the result of a vasospa Dandy [1] in 1931 and Adson [2] in 1934 repo excellent results in migraine from sympath tomy.

There is a definite drop in intraocular pr sure following sympathectomy. It is essen that the proper sympathetic nerves be regula as in migraine the proper sympathetic nerves the lower cervical group. This group enters cranium by way of the vertebral arteries.

Apparently sympathectomy does not o pletely stabilize the blood flow but prevents n mal constrictions or dilatations. It has b shown that sympathectomized extremities re to exercise, heat and other stimulants by greater flow of blood to the parts. It is appar that certain responses of the blood vessels preserved in the denervated state, the stimul being derived from the tissues or the blood its To summarize, Ménière's disease is a vasom disturbance caused either by blood-borne irrit affecting the sympathetic nerves to the part by local tissue metabolites acting on the s nerves. The actual mechanics of Ménière's ease is an extravasation of serum into the s media.

FURTHER REPORT OF A CASE [2a]

Ganglionectomies were performed, including the perior cervical ganglions, and the trunks from midcervical ganglions were removed. Examinatio the ganglions (Dr. Budd) showed changes, the sig cance of which could not be determined. The instead of being plump and rounded were crenated

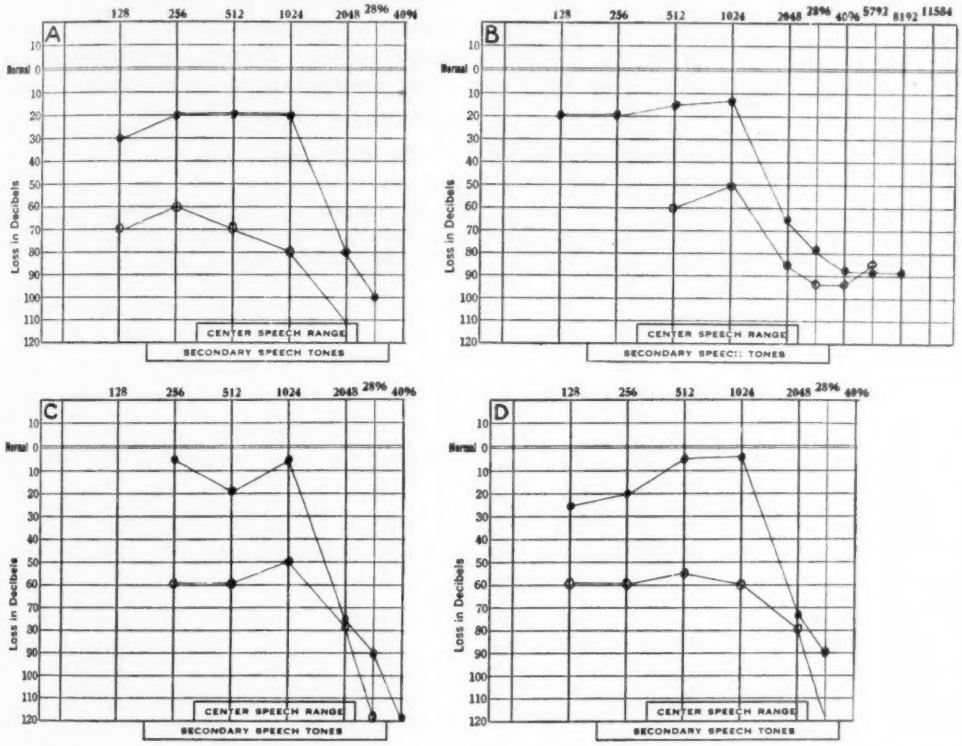
1. Dandy, W. E.: Treatment of Hemicrania graine) by Removal of Inferior Cervical and Thoracic Sympathetic Ganglion, Bull. Johns Hop Hosp. **48**:357-361 (June) 1931.

2. Adson, A. W.: Right Frontotemporal Migr Relieved by Surgical Methods: Report of Case, P Staff Meet., Mayo Clin. **9**:673-676 (Nov. 7) 1934.

2a. Mogan, R. F., and Baumgartner, C. J.: Ménié Disease Complicated by Recurrent Interstitial Ker tis: Excellent Result Following Cervical Ganglio tomy; Report of Case, West. J. Surg. **42**:628 (N 1934.

d margins. They showed chromatolysis, and the plasm was vacuolated in some instances. The i were often atrophic and frequently eccentrically d. Sections were sent to Dr. J. W. Kernohan, of Mayo Clinic, who likewise reported a deviation the normal, the significance of which he could not He reported azure granules in the cytoplasm of of the cells, slight chromatolysis in the centers me of the cells and some thickening of the blood ls.

e after-effects of the operations were the same oth sides: marked epiphora, injection of the conivas, signs resembling acute coryza, i. e., congestion e mucous membrane and mucous and serous dise. The throat felt inflamed. The voice was se, and the vocal cords were injected. The symp-



udiograms of the patient: *A,* taken Jan. 2, 1932, shortly after operative treatment for Ménière's disease. aken Sept. 28, 1937. *C,* taken Aug. 11, 1939. *D,* taken July 18, 1942, twelve years after the operation. ring in the left ear is represented by white circles; that in the right ear, by black circles.

indicated that the vasoconstrictor mechanism was st temporarily blocked. Within a week the symp- subsided. The conjunctivas resumed their normal arance but the mucous membrane of the nose and t that had been somewhat dry and tending toward ing had returned only partially to its old condition more closely resembled a normal mucous mem- . The vocal cords were normal. (From the going description a line of treatment suitable for is suggested. Of course, the production of vas- dilatation in the area of ozena would be valueless condition had progressed to total destruction of mucous membrane, which one sees in many cases.) cloudiness of the corneas had to a great extent peared, to the degree that the vision in both eyes normal.

there is no collateral circulation in the human al ear, it is quite certain that there was no xy in this instance, because of the marked restora- of hearing following the operations. It is not expected that there will be improvement in all cases because, no doubt, as probably occurred in the left ear of this patient, there is total destruction of the nerve endings. Following surgical treatment, the patient was able to hear voices without an amplifier. This improvement was noticeable while the patient was still in the hospital after the last operation. Tests of the hearing have been made at intervals during the past twelve years. Audiograms show no appreciable change in the past five years.

There has been no vertigo since the surgical intervention and no further loss of hearing. There have been occasional head noises which lasted a short time and apparently were noted only when he was fatigued. The eyes cleared to the point where only slight opacities were noted in the corneas. He has complete muscular coordination except when walking on rough ground or swimming. As with many deaf people, his voice is a monotone.

COMMENT

The operative procedure is not a cure; it does no more than stop the vasoconstrictor impulses going to the vessels of the ear and cause a more stable flow of blood in the part.

The sympathetic irritation in Raynaud's disease is sufficient to produce gangrene of such tissues as those of the hands and the feet. How much less irritation is sufficient to produce destruction of such highly specialized tissue as the eighth nerve endings!

Dandy's approach to Ménière's disease is sound except for the fact that the degenerative

process in the internal ear is not stopped by the operation. The vertigo, tinnitus and other symptoms may be stopped by the operation, but the loss of hearing continues and in some instances the tinnitus continues. Shelden and Horton,[3] of the Mayo Clinic, who reported excellent results with the histamine treatment, probably have found one of the causes of the degeneration of the ganglions or nerves. Furstenberg's [4] treatment with ammonium chloride, eliminating as much as possible sodium, may have its effect by reducing the edema in the internal ear or in the ganglions. Results from this treatment have not been as spectacular as those from the histamine therapy.

Hallpike and Cairns [5] expressed the belief that the primary mechanism of the disease was an obstructive distention of the endolymph system. In autopsies in their cases they observed marked dilatation of the scala media with almost complete obliteration of the scala vestibuli. Ménière's syndrome may be caused by many agents, but the mechanics are the same regardless of the irritant. A vasodilatation or a vasoconstriction due to excessive stimulation of either branch of the sympathetic nerve to the internal ear causes excessive responses as in Raynaud's disease. The effect is either an immediate excessive filtration into the scala media or a secondary reaction following a marked vasoconstriction. The irritants are blood borne. Hyperconstriction in itself may cause destruction of such highly sensitive structures as the organ of Corti.

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3. Shelden, C. H., and Horton, B. T.: Treatment of Ménière's Disease with Histamine Administered Intravenously, Proc. Staff Meet., Mayo Clin. **15**:17-21 (Jan. 10) 1940.

4. Furstenberg, A. C.; Lashmet, F. H., and Lathrop, F. D.: Ménière's Symptom Complex: Medical Treatment, Ann. Otol., Rhin. & Laryng. **43**:1035-1047 (Dec.) 1934. Furstenberg, A. C.; Richardson, G., and Lathrop, D. F.: Ménière's Disease: Addenda to Medical Therapy, Arch. Otolaryng. **34**:1083-1092 (Dec.) 1941.

5. Hallpike, C. S., and Cairns, H.: Observations on Pathology of Ménière's Syndrome, J. Laryng. Otol. **53**:625-654 (Oct.) 1938.

THROMBOPHLEBITIS OF THE LATERAL SINUS

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uppurative thrombophlebitis generally de-
ps secondary to an adjacent suppurative fo-
whether this be in the axilla, the thigh or
head. So far as the lateral sinus is con-
ed, the pathologic process begins with peri-
bitis involving that part of the lateral or the
oid sinus or the superior bulb of the internal
ular vein which is in direct contact with in-
d tissue. If the periphlebitis with infection
he adventitia and penetration of the venous
persists for a variable time, a thrombus
ns. The thrombosis occurs secondary to in-
on of the venous wall and is not primary.
erally the formation of a thrombus results
the infection has reached the intima. It is
of the reparative process. In support of
concept Klemperer [1] reported a case of
hof's in which bacteria were found in the
of the vein without any formation of a
mbus within the vein. Similar reports have
recorded by Haymann [2] and by Caldera
Finzi.[3]

lemperer, discussing Neuhof's [4] report of
case, concluded that if one wishes to prevent
progress of thrombophlebitis, one must start
rying to combat infection of the venous wall.

. Ligation of the vein in thrombophlebitis can
prevent the spread of bacteria into the circulation.
nnot prevent the spread of the process within the
. . . Ligation of the vein beyond the thrombus
at bacteria are prevented from entering the circu-
n gives a gain of time for spontaneous limitation
e thrombophlebitis. However, one has to consider
the collateral veins empty into the circulation and
only rational way to handle the situation . . .

rom the Otologic Service of Dr. J. L. Maybaum,
nt Sinai Hospital.

resented as a candidate's thesis to the American
ngological, Rhinological and Otological Society in

Klemperer, P., in discussion on Neuhof.[4]

Haymann, L.: Die otogene Sinusthrombose und
otogene allgemeine Infektionen, in Denker, A., and
er, O.: Handbuch des Hals-Nasen-Ohrenheil-
e, Berlin, Julius Springer, 1925.

Caldera, C., and Finzi, G.: Contributo clinico-
mentale alla questione trombosi di origine otitica,
ital. di otol. **24**:392-416, 1913.

Neuhof, H.: Excision of Vein for Suppurative
mbophlebitis, Ann. Surg. **106**:311-313 (Aug.)

is to attack it radically and resect the infected vein, without leaving it to chance for the process to become self-limited.

This is sound surgical advice, but unfortunately thrombophlebitis of the lateral sinus and of the bulb of the jugular vein does not lend itself to this surgical treatment.

To evaluate the effectiveness of the present surgical therapy for thrombophlebitis of the lateral sinus, one must determine what the specific therapy does to eradicate those features of the disease which make thrombophlebitis of this sinus the serious condition which it is. In order to determine the effectiveness of the present therapeutic approach, it is my purpose to present an analysis of the last 100 cases of thrombophlebitis of the lateral sinus in which operation was resorted to at the Mount Sinai Hospital, New York.

The method of treatment generally employed had as its purpose an exposure of the lateral sinus wide enough to encompass the limits of the disease, the opening of the parietal wall of the sinus, the removal of the thrombus when one was present, the excision of part of the diseased parietal wall and the establishment of free bleeding from the torcular and bulbar ends. If there was doubt as to the safety of leaving the internal jugular vein patent, it was the consensus of the otologic department that the vein should be ligated. In some instances ligation was carried out at a subsequent operation because of persistence of the bacteremia. In other instances it was never necessary to ligate the internal jugular vein because obliteration of the lateral sinus sufficed to cure the general invasion. I realize from analysis of the literature that this type of material is not reported in any standard manner; therefore I shall endeavor not to present the material in any comparative fashion but to evaluate the results of treatment in the aforementioned series of cases. I shall also present the pathologic and operative data in order to determine whether there is any correlation between the clinical course and the pathologic observations at operation.

Table 1 indicates that in the vast majority of the cases in this series thrombophlebitis of the

lateral sinus occurred in the age period from 9 months to 10 years. It occurred oftener in the five year period from 6 to 10 years (39) than in any subsequent ten year period of life. The age period up to 30 years includes 90 per cent of all the cases in this series. Sixteen of the 100 patients were children below 5 years of age. One of these was a 9 month old infant. These figures are in accord with those reported by Meltzer.[5] Mastoiditis is relatively uncommon in aged persons, and this explains the apparently low incidence of thrombosis of the lateral sinus in them. According to Jansen,[6] Hessler,[7]

TABLE 1.—*Distribution of Cases with Respect to Periods of Life*

9 Mo. to 10 Yr.		11 to 20 Yr.	21 to 30 Yr.	31 to 40 Yr.	41 to 50 Yr.	51 to 60 Yr.	61 to 70 Yr.
9 mo. to 5 yr.	16						
6 to 10 yr.	39	26	9	3	2	3	2
	55						

Forselles,[8] Coates, Ersner and Persky[9] and others, thrombophlebitis of the lateral sinus affects males three and one-half times as frequently as females. In Meltzer's series there were more males than females; in my series 62 of the 100 patients were males.

ANALYSIS OF THE PATHOLOGIC MATERIAL

The inflammation in the lateral sinus varied in degree from patchy thrombophlebitis with slight thickening and cellular infiltration of the wall of the sinus or the bulb to an obturating thrombophlebitis from the bulb to beyond the torcular Herophili, with necrosis of the wall of the vein. Friesner,[10] Neuhof,[11] Druss[12] and others pointed out that the size and the extent of the thrombus need not correspond to the area of the adjacent phlebitis. This phlebitic process is undoubtedly the important factor in the persistent bacteremia frequently noted after removal of a large infected thrombus.

There were 55 cases in which specimens of the wall of the lateral sinus were removed at operation and examined pathologically.

TABLE 2.—*Pathologic Changes in the Wall of the Thrombosed Lateral Sinus as Observed in Specimens Removed at Operation in Fifty-Five Cases*

Pathologic Changes	Cases	Comment
"Obturating thrombus"	16	
"Mural thrombus" "Suppurative thrombophlebitis" "Acute thrombophlebitis" "Phlebitis"	33	
"Chronic inflammation but no purulent inflammation or bacteria observed"	1	Case 10: Two positive blood cultures before operation; obliteration of sinus and ligation of bulb of jugular vein; blood culture after operation negative; preoperative metastatic focus in kidney subsided
"Acute purulent inflammation of outer layer but no thrombophlebitis"	2	Case 42: At operation, granulation on sinus wall; sigmoid sinus diseased throughout; purulent obturating thrombus removed Case 57: Sinus wall bluish and loose, healthy throughout; no thrombus could be demonstrated in bulb; patient made smooth uneventful recovery; no evidence of septicemia after operation
"No evidence of thrombophlebitis"	3	Case 43: Patient died eight hours after operation; temp., 109 F.; at operation sigmoid sinus incised, no bleeding; an old thrombus removed; no bleeding from the bulb. Impression: patient had thrombosis of bulb with extension of thrombus back, and specimen of sinus which was removed can be thus explained Case 55: Patient died of meningitis 3 days after operation on sinus and bulb and 13 days after radical mastoidectomy; operation on sinus showed intima thickened; very slight bleeding from bulb; no plug needed; postmortem histologic section showed primary thrombophlebitis of bulb Case 81: At operation, mastoid process sclerosed; no pus; wall of sinus glisterless, when sinus was incised free bleeding from bulb and torcular end. In view of clinical findings and course this was considered a primary bulbar phlebitis, and this would explain the report that specimen of sinus wall taken showed "no evidence of thrombophlebitis." Patient made complete recovery 36 days after operation

There were 45 cases in which no report of histologic examination of a specimen from the sinus wall removed at operation was recorded.

There were 5 cases in which at operation sections of the sinus wall were removed (73,

5. Meltzer, P. E.: Treatment of Thrombosis of Lateral Sinus, Arch. Otolaryng. **22**:131-142 (Aug.) 1935.

6. Jansen, A.: Ueber Hirnsinusthrombose nach Mittelohreiterungen, Arch. f. Ohrenh. **36**:1-54, 1893-1894.

7. Hessler, T. A. H.: Die otogene Pyämie, Jena, G. Fischer, 1896.

8. af Forselles, A.: Die durch eitrige Mittelohrentzündung verursachte Lateralsinusthrombose und deren operative Behandlung, Kuopio, O. W. Backman, 1893.

9. Coates, G. M.; Ersner, M. S., and Persky, A. H.: Lateral Sinus Thrombosis with a Review of the Literature, Ann. Otol., Rhin. & Laryng. **43**:419-440 (June) 1934.

10. Friesner, I.: Infections of the Middle Ear: Acute Systemic Infections from the Ear, Arch. Otolaryng. **14**:257-265 (Sept.) 1931.

11. Neuhof, H.: The Diagnosis and Operative Control of Acute Pyogenic Phlebitis Complicated by General Septic Invasion, Ann. Surg. **97**:808-822 (June) 1933.

12. Druss, J. G.: Thrombosis of the Lateral Sinus: A Study of Fifteen Cases Including Histologic Examination, Arch. Otolaryng. **29**:42-64 (Jan.) 1939.

54 and 94) but in which the chart carried no ort of the results of histologic examination. case 73 the "sinus wall was discolored below knee. The remainder of the sinus appeared mal; free bleeding was obtained; no thrombus

BLE 3.—*Clinical Observations on Thrombosed Lateral Sinus at Operation in Forty-Five Cases*

Clinical Description of Changes Observed at Operation	Cases	Comment
turating thrombus"	13	
lebitis"	10	
ral thrombus"	2	
coming from lumen of us"	2	
s: "Sinus did not appear ossly abnormal"	18	Case 8: Question whether patient had rheumatic endocarditis before operation Case 9: Traumatic thrombosis of sinus occurred six days after mastoidectomy Case 13: Thrombosis of sinus with benign intracranial hypertension resulting after operation
9: "No abnormality"		
13: "Sinus opened, bled ely from bulb and rcular end"		
foregoing statements are pical of the descriptions these cases		

ld be felt." In case 64 there was a "large lesteatoma in the antrum and in contact with sinus, which was covered with granulations. obturating thrombus was found. There was bleeding from the bulb." In case 54 the the sinus appeared yellowish." In case 66 the "sinus wall was definitely diseased, gray, thickened and lusterless. There was a mural thrombus, and the wall of the vein was thickened."

There were 18 cases in which no specimen was taken from the sinus wall at operation and in which the clinical description of the operation was characterized by such reports as: "The sinus was opened; no thrombus was demonstrable; free bleeding was obtained from the bulbar and torcular ends." "The sinus appeared normal and bled freely." "The sinus appeared blue and contained blood." "The right lateral sinus was incised, with free bleeding; no definite disease noted." In other words, in these 18 cases there was no proof in the operative description of thrombophlebitis of the lateral sinus.

Of the 18 patients in whose cases there was no pathologic examination of a specimen excised from the sinus wall and scant evidence of disease on inspection of the sinus at operation, 7 died—6 of meningitis and 1 of spontaneous hemorrhage from a branch of the deep femoral artery secondary to suppuration of the hip.

In case 9 death occurred from meningitis, and the postmortem examination, limited to examina-

TABLE 4.—*Data on Eighteen Cases in Which No Pathologic Examination of Sinus Wall Was Recorded*

Case	Blood Culture		Chills		Excerpts from Operative Observations	Outcome
	Preoperative	Postoperative	Preoperative	Postoperative		
8	Positive	Not taken	Present	Present	Bled freely; did not appear grossly abnormal	Patient well
9	Positive	Negative	None	None	Traumatic thrombophlebitis of sinus; sinus normal before trauma	Patient died
13	Positive	Not taken	Present	None	Sclerosed mastoid process with cholesteatoma; sinus bled freely	Patient well
26	Positive	Positive (10 days)	Present	None	Sinus appeared blue on both sides and "contained blood"; not obliterated	Patient well
31	Positive	Not taken	None	None	Appeared normal; bled freely.....	Patient well
36	Positive	Positive (2 days)	None	Present	Sinus bled freely; no thrombus demonstrable	Patient died
44	Positive	Positive (2 days)	None	None	Moderate bleeding from area of perisinal abscess; free bleeding from behind	Patient died
58	Positive	Positive (2 and 14 days)	Present	Present	On revision, pus from bulb; "no evidence of thrombus; very active bleeding"	Patient well
72	Positive	Positive (3 days)	Present	None	"Reddish brown near bulb; free bleeding; no thrombus"	Patient died
73	Positive	Positive (4 days)	Present	None	"Discolored below knee; free bleeding; no thrombus"	Patient died
87	Positive	Positive (4 days)	Present	None	"Free bleeding from bulb and torcular end; no thrombus"	Patient well
90	Positive	Negative	Present	Present	"Sinus gray, lusterless; free bleeding; no thrombus"	Patient well
92	Positive	Negative	Present	Present	At knee sinus appeared grayish; free bleeding	Patient died
95	Positive	Positive (4 days)	Present	Present	"Sinus below knee appeared unusually white; bled profusely"	Patient died
30	Negative	Negative	Present	Present	Appeared normal and bled freely	Patient well
40	Negative	Not taken	Present	None	No abnormality noted.....	Patient well
49	Negative	Positive (12 days)	Present	Present	"Free bleeding; no demonstrable pathology"	Patient well
82	Negative	Negative	Present	Present	"Sinus white and thickened".....	Patient well

ll of the lateral sinus was grossly diseased and eared grayish. There was no bleeding from bulb or the superior petrosal sinus when the ral sinus was incised. The sinus bled from the cular end." In case 94 the "clot and a part he sinus wall were removed; near the knee tion of the wound, revealed at the knee of the lateral sinus a grayish brown and red adherent thrombus which extended far beyond the line of surgical compression up to the torcular Herophili. A portion of the cerebellum adjacent to the sinus showed a small amount of fibrinous exudate.

In case 36 death was due to meningitis, and the postmortem examination revealed absence of infection at the torcular end of the sinus. However, there was a thrombus in the bulb of the jugular vein undergoing resolution. There was purulent exudate in the inferior petrosal sinus, and the superior petrosal sinus contained an organized thrombus. A purulent thrombus was present in the sigmoid sinus. In the internal auditory metaus purulent exudate was present.

In case 32 death followed a hemorrhage from erosion of a branch of the deep femoral artery, secondary to extensive suppuration in and about the hip joint. This accident occurred two months after operation on the sinus and ligation of the internal jugular vein. The sites of these procedures were healed.

In case 25 death was due to meningitis, and histologic examination revealed in the sigmoid sinus a purulent thrombus which showed little evidence of organization. The visceral wall of the sinus showed periphlebitis and necrosis. A similar process was present about and in the bulb of the jugular vein.

Comment.—Death occurred in 7 cases in this group, in 4 of which there was postmortem examination. Histologically, extensive involvement of the bulb was observed in 2 cases. This might explain the meager evidence of disease at the original operation, particularly if the patients were operated on early. Permission for postmortem examination was not obtained in cases 73, 72 and 44.

In cases of primary thrombosis of the bulb of the jugular vein it is common to note a relatively normal sigmoid and lateral sinus, particularly if the patient is operated on early in the disease, before there is time for the thrombophlebitic process to extend backward and upward toward the sigmoid and the lateral sinus. This statement is substantiated by clinical and pathologic data (Maybaum and Goldman,[13] McKernon[14] and others). It is my belief that in the majority of cases in which the sinus appeared normal the condition was thrombophlebitis of the bulb. Of course, one must recognize that early in the course of thrombophlebitis of a lateral sinus, one may overlook grossly a small area of early thrombophlebitis of the sinus, especially since the incision of the involved sinus is followed by such profuse bleeding that adequate inspection is not possible. One cannot be sure, therefore, that the excised portion included the diseased area of the sinus.

13. Maybaum, J. L., and Goldman, J. L.: Primary Jugular Bulb Thrombosis, Arch. Otolaryng. **17**:70-84 (Jan.) 1933.

14. McKernon, J. F.: Primary Jugular Bulb Thrombosis in Children, New York M. J. **82**:4 and 57, 1905.

BLOOD CULTURES

In 3 of the 100 cases of thrombophlebitis of lateral sinus the sinus was operated on before report on the blood culture was received. In of the remaining 97 cases a positive blood cul was obtained before operation on the sinus ligation of the internal jugular vein. In the cases a negative blood culture was recor before operation. It is interesting to note 50 per cent of the patients with positive bl cultures were children up to 10 years of Seventy-one of the 80 patients with posi blood cultures were included in the group f infancy to 30 years of age. In the 80 case

TABLE 5.—*Age Distribution of Cases in Which Posi Blood Cultures Were Obtained Before Operatio on the Lateral Sinus and Ligation of the Internal Jugular Vein*

9 mo. to 10 Yr.	11 to 20 Yr.	21 to 30 Yr.	31 to 40 Yr.	41 to 70 Yr.	To
40 cases	24 cases	7 cases	3 cases	6 cases	

which positive blood cultures were obtained operatively, the organisms recovered were beta type of hemolytic streptococcus (68 cas an anaerobic strain of Streptococcus haemolyt (5 cases), Pneumococcus type III (3 cas Bacillus proteus (2 cases), Staphyloco aureus (1 case) and Bacillus pyocyaneus case).

The organism usually isolated from the bl stream in cases of thrombophlebitis of the la sinus is Str. haemolyticus and, as stated by G man,[14a] bacteriologic investigations indicate with rare exceptions thrombosis of the la sinus is essentially a disease caused by haemolyticus. He isolated the hemolytic stre coccus from 95.7 per cent of the patients pr to have bacteremia associated with otitic se The symptoms of sepsis, when caused by strictly anaerobic type of Str. haemolyt according to Friesner,[10] evidence an excess virulent nature. In this series the sepsis du the anaerobic type of Str. haemolyticus attended with severe mortality and morbi In 3 cases (37, 72 and 88) the patient died, in the other 2 (74 and 86) the patient recov after prolonged illness (seventy-eight days). the cases in which recovery occurred nume metastatic foci were present, requiring inci and drainage, which accounts for the protra morbidity.

Thrombosis of a lateral sinus due to Bac proteus was observed twice in the series.

14a. Goldman, J. L.: Blood Cultures in Cas Otitic Sepsis, Arch. Otolaryng. **30**:516-524 (Oct.)

been reported by Gerzog,[15] McGovern,[16] min and Simms,[17] Cragg,[18] Smith and r[19] and Kernan.[20] Certain characteristics proteus infections were stressed by these ors and were noted by me. One is the fre- t occurrence of B. proteus in chronic sup- tion of the middle ear, where it usually is a ndary invader. The frequency with which lications (perisinal abscess, thrombosis of ateral sinus, meningitis and abscess of the) occur is striking. Both the 2 patients this infection in the series (cases 27 and 78) acute exacerbations of chronic suppuration e middle ear. Both had necrotic thrombi in ateral sinus. They were treated in the usual ion (obliteration of the sinus and ligation of nternal jugular vein), and both made un- tful recoveries. In neither case were metas- noted. Some authors reporting on this tion believe they have seen good results the use of bacteriophage.

neumococcus type III septicemia occurred times in this series. The association of mococcus type III infection in patients with etes has been pointed out by Maybaum Druss,[21] Shwartzman and Goldman[22] and s. (Case 5 was that of a 53 year old woman diabetes who recovered. Case 20 was that 63 year old woman with diabetes who died of ngitis. Case 93 was that of a 55 year old who died of meningitis.) Maybaum and s reported that in 52 per cent of their cases neumococcus type III infection the disease rred in the fifth, sixth and seventh decades e. The occurrence of this organism in dis- of the middle ear in children and especially ts is not attended with the same serious nostic import that is associated with the presence of the organism in adults. The bacteriologic characteristics of the organism have been adequately described in an excellent communication by Goldman[14a] and need not be repeated here. Suffice to say that it is a virulent organism which is more prone to give rise to otitic complication than the more commonly found beta type of Str. haemolyticus. As has been stated by Libman,[24] Friesner, Druss, Goldman and Rosenwasser,[25] type III is the only type of pneumococcus that I have found to cause thrombosis of the lateral sinus.

The serious nature of infections in diabetic patients is a matter of daily clinical experience. The experiments of Pillsbury and Kulchar,[26] Richardson[27] and others indicate that increased sugar content of blood and tissues is not significant in bringing about increased growth of bacteria in the body or in diminishing the resistance of the host. According to Moolten[28]:

TABLE 6.—*Duration of Bacteremia After Surgical Treatment in Cases in Which Blood Cultures Were Positive Before Operation*

Duration After Operation	Cases	Duration After Operation	Cases
1 day	2	10 days	1
2 days	6	11 days	1
3 days	7	14 days	2
4 days	3	15 days	3
5 days	3	19 days	1
7 days	4	24 days	1
9 days	2		

Recent studies strengthen the view that the lowered resistance to infection in persons with diabetes is primarily an aspect of faulty metabolism of the tissues. The evidence at present does not, however, localize the impaired resistance within the cellular elements the activity of which is specifically anti-infective, such as the reticulo-endothelial system, the lymphatic system and the leukocytes. Instead, the fault apparently resides within all tissues of the body and concerns their intrinsic biologic capacity to withstand injury and intoxication of any kind, whether infectious, chemical or ischemic.

Of the 80 patients who had positive blood cultures before the operation on the sinus and the ligation of the internal jugular vein, 36 had

Gerzog, B. G.: Bacillus Proteus in Otogenic tions, Secondary Mastoiditis, Thrombosis of Lateral and Bacteremia, Arch. Otolaryng. **30**:274-279) 1939.

McGovern, F. H.: Fatal Otogenic Infection with roteus: Report of Two Cases, Arch. Otolaryng. 8-621 (Nov.) 1936.

Dearmin, R. M., and Simms, J. L.: Thrombosis teral Sinus and Abscess of Temporal Lobe Due to lus Proteus, Arch. Otolaryng. **32**:1098-1101 (Dec.)

Cragg, N. R.: Otitic Meningitis Due to Bacillus us, Arch. Otolaryng. **34**:345-348 (Aug.) 1941.

Smith, A. B. P., and Miller, S.: Lateral Sinus mbosis Due to Bacillus Proteus, Lancet **1**:862 il 13) 1935.

Kernan, J. D., Jr.: Two Cases of Infection by B. us, Laryngoscope **32**:304-310 (April) 1922.

Maybaum, J. L., and Druss, J. G.: Otitic In- ns Due to the Type III Pneumococcus, Arch. ryng. **30**:21-37 (July) 1939.

Shwartzman, G., and Goldman, J. L.: Strepto- s Haemolyticus Bacteremia, Arch. Surg. **34**:82-98) 1937.

23. Footnote has been deleted.

24. Libman, E.: Six Cases of Thrombosis of the Lateral Sinus, Tr. Am. Otol. Soc. **10**:304-315, 1906.

25. Friesner, I.; Druss, J. G.; Goldman, J. L., and Rosenwasser, H.: Sinus Thrombosis, Am. J. Surg. **42**: 116-130 (Oct.) 1938.

26. Pillsbury, D. M., and Kulchar, G. V.: Relation of Experimental Skin Infection to Carbohydrate Metabolism, Am. J. M. Sc. **190**:169-178 (Aug.) 1935.

27. Richardson, R.: Immunity in Diabetes: Influence of Diabetes on Development of Antibacterial Properties in Blood, J. Clin. Investigation **12**:1143-1149 (Nov.) 1933.

28. Moolten, S. E.: Pulmonary Infection and Necrosis in Diabetes Mellitus, Arch. Int. Med. **66**:561-578 (Sept.) 1940.

positive blood cultures after operation and ligation. Table 6 indicates the number of days that the blood cultures were positive after operation and ligation.

There were 36 patients who had positive blood cultures from one to twenty-four days after operation and ligation. Some of the patients had more than one positive blood culture after these surgical procedures; the figure given indicates the date of the last positive blood culture. As indicated in table 6, in most of the cases (25 of 36) the last positive blood culture was obtained in the first week after the operation.

The greatest expression of the disease in 22 cases was mainly in and adjacent to the bulb of the internal jugular vein; in a small number there was in addition thrombosis of the torcular end. In 9 there was actually frank pus in the bulb. In 4, in which the sinus bled freely and in which there was no demonstrable thrombus, the possibility of primary phlebitis of the bulb was considered. In 1 instance in which a positive blood culture was noted twenty-four days after the obliteration of the lateral sinus (the internal jugular vein was not ligated) the clinical course was such as to merit a brief report.

CASE 20.—A woman aged 63, with severe diabetes, in the medical service presented evidence of mastoiditis. In addition, she had sepsis, chills and a blood culture positive for Pneumococcus type III, 20 colonies per cubic centimeter. On May 2 mastoidectomy and obliteration of the lateral sinus were performed. The mastoid process was extensively diseased. There was frank pus in the lateral sinus, with no bleeding from the bulb and only slight bleeding from the torcular end. The internal jugular vein was not ligated at this time. The patient was given intensive chemotherapy for thirteen days. She then seemed perfectly well and was walking around, symptom free. On May 24 she complained of headache and had a temperature of 101 F. The patient had a chill lasting fifteen minutes. A blood culture was made and was found positive for Pneumococcus type III. On May 26, the internal jugular vein was ligated; it appeared normal. Revision of the operation on the sinus was performed. The sinus was slit open all the way back to the torcular Herophili, but no bleeding occurred. The picture was that of organizing suppurative thrombophlebitis. Chemotherapy was begun again, but despite this the blood culture remained positive and the patient died of meningitis. Postmortem examination revealed extension of the purulent thrombophlebitis into and through the torcular to the opposite lateral sinus, with extension of the process into the straight sinus.

Case 20 illustrates the inherent dangers of type III pneumococcus bacteremia in diabetes. This patient had been receiving chemotherapy and was seemingly well, afebrile, with diabetes under control, walking about the ward, when twenty-two days after operation, she had a chill, a temperature of 102 F. and again a positive blood culture. Physicians well know that Pneumococcus type III infections behave insidiously. When the condition is complicated by chemotherapy, with masking effect, the symptomless extension of obliterating thrombus to the torcular Hero and over to the opposite lateral sinus can re be understood.

In other instances, reoperation with rem of a thrombus and excision of more of the wa the lateral sinus, toward the torcular Hero caused cessation of the bacteremia. In 1 insta (82) the patient had a positive blood cul three days after operation, and when revisio the operation was performed, the removal of plug from the region of the superior petr sinus was followed by a gush of pus. From t on, the patient made a complete recovery. another instance (74) the patient suffered fr septicemia, which abated only when 4 ou (113 Gm.) of thick pus about the hip drained. This type of focus can account transitory bacteremia but does not cause c tinued bacteremia. The onset of meningitis i small percentage of cases accounted for b teremia, but again such a development does explain continued bacteremia.

There were 17 patients who had negative bl cultures before operation and 3 who were s mitted to operation on admission without bl being taken for culture. These were: the pat in case 56, aged 5 years, who had puru thrombophlebitis, with free pus coming from lumen of the sinus; the patient in case 51, a 5½ years, who had purulent obliterating thr bophlebitis; the patient in case 15, aged years, who had a large epidural and peris abscess, with pus coming from the lumen of lateral sinus. In the cases of these 3 pati postoperative blood cultures were not m because of the smooth, uneventful postop tive course, uncomplicated by fever, chills metastases.

The age distribution of the 17 cases with operative negative blood cultures is shown table 7. Fifteen of the 17 cases are include the age group up to 30 years.

TABLE 7.—*Age Distribution of Cases in Which N tive Blood Cultures Were Obtained Before Oper tion on the Sinus and Ligation of the Internal Jugular Vein*

9 mo. to 10 Yr.	11 to 20 Yr.	21 to 30 Yr.	31 to 40 Yr.	41 to 50 Yr.	51 to 60 Yr.	61 to 70 Yr.
9 cases	3 cases	3 cases	1 case	1 case	..	..

In 8 of these 17 cases the blood cultures w positive after operation and ligation, and tab indicates the number of days after opera during which the cultures were positive.

here were 8 patients who had positive blood ures from one to forty-two days after the s-jugular vein operation. Some of these nts had more than one postoperative positive d culture; the figure given indicates the date he last positive blood culture. As indicated able 8, in most of the cases (6 of 8) the last tive blood culture was obtained in the first t days after the operation.

n 4 cases (55, 69, 72 and 53) the major ologic expression was confined to the bulb o the area adjacent to it.

ne patient (case 92) had pus coming from lumen of the sinus in the region of the ssary vein. One patient (case 99), with a tive blood culture five days after operation, a thrombus removed from the lateral sinus. his patient, after drainage of a huge cerebellar

ABLE 8.—*Duration of Bacteremia After Surgical Treatment in Cases in Which Blood Cultures Were Negative Before Operation*

tion After eration	Cases	Duration After Operation	Cases
day	1	8 days	1
days	1	19 days	1
days	2	42 days	1
days	1		

ess, terminal meningitis developed. One nt (case 14) had a positive blood culture -two days after operation and ligation. A iled description of this case is warranted use of its extreme interest.

SE 14.—Mastoidectomy was performed on a child rs of age. The mastoid process was extensively dis- . The lateral sinus was exposed purposefully at time because the patient had a temperature of F. It appeared normal. A metastasis developed e left hip on June 3. The sinus was operated on, ligation of the internal jugular vein, the same day. bitis of the parietal wall was observed. On June 6 emperature was 105.4 F. A metastasis in the elbow was noted. On June 25 the temperature was F., and a blood culture was positive for Str. olyticus, beta type. This was thought possibly to e to the pyarthrosis of the hip joint. On July 2 lood culture was again positive. The sinus was olored, but no local cause for the persistent septi- was discovered. On July 5 the left hip was ated and thick greenish pus under great pressure btained. Incision with drainage of the hip joint was rmed. On July 8 a parapharyngeal abscess was in- and drained. This was believed to be secondary fection about the bulb. On July 17 the patient's erature was 104.4 F. The blood culture was posi- again, forty-two days after the original operation e lateral sinus. Chemotherapy had to be discon- d because agranulocytosis developed. With repeated fusions, and after prolonged illness, the patient y recovered and was discharged with some dis- y resulting from the suppuration in the hip.

nalysis of these cases indicates that bacte- a was one of the most constant and serious features. Blood cultures were helpful in the postoperative management. Repeated growth of the micro-organisms in cultures after operation suggested that the infected lateral sinus or the bulb had not been entirely excluded from the circulation. Not infrequently, in conjunction with the other manifestations of bacteremia, it indicated the necessity of draining an abscess in the bulb or obliterating more of the torcular end of the lateral sinus.

The part that blood cultures play in differential diagnosis has been adequately discussed in a previous communication.[29]

Comment.—A high percentage of positive blood cultures, perhaps as a result of the meticulous blood culture technic, has proved to be one of the constant features noted (80 of 97 cases). Patients suffering from sepsis, however, may have negative blood cultures (17 of 97). As to this group, I am in accord with Neuhof, Aufses and Hirshfeld,[30] who declared that closer attention to clinical manifestations and less slavish reliance on laboratory data often will lead to earlier diagnosis and to the utilization of appropriate surgical measures. Furthermore, there is some justification in the criticism of the point of view of some clinicians, who withhold action that could have been taken at a given time until a blood culture has proved to be positive. This may be justified in many instances, but to apply it to all, according to the aforementioned authors, can mean only an unwarranted reliance on the laboratory, a lack of appreciation of the significance of negative blood cultures and, in some instances, the postponement of appropriate action until too late to save the patient. I feel that prompt, early obliteration of the sinus and ligation of the internal jugular vein, to which

TABLE 9.—*Résumé of the Reports of Blood Culture in This Series*

Preoperative	Postoperative
80 patients had one or more preoperative positive blood culture, and of these →	36 had positive blood cultures postoperatively (25 of these within 7 days after operation)
17 patients had one or more preoperative negative cultures, and of these →	8 had positive blood cultures postoperatively (6 of these within 8 days after operation)
3 patients had no blood cultures made preoperatively, and of these →	3 had no blood cultures made postoperatively because of an excellent clinical course

29. Rosenwasser, H.: Differential Diagnosis Between Thrombosis of the Lateral Sinus and Acute Bacterial Endocarditis, Arch. Otolaryng. **26**:668-686 (Dec.) 1937.

30. Neuhof, H.; Aufses, A. H., and Hirshfeld, S.: Pyogenic Sepsis: A Survey of One Hundred and Fifty Cases, Surg., Gynec. & Obst. **58**:886-896 (May) 1934.

Portmann [31] attributed his magnificent results (no deaths in eight years), will do much to diminish the relatively high morbidity and mortality.

CHILLS

Sixty-three patients had one or more shaking chills preoperatively. They were grouped according to periods of life, and from table 10 it is evident that 58 of the 63 patients who had real chills were below 30 years of age, and the vast majority of these (52 of 63) were below 20 years of age. Greenfield [32] reported that 15 of 22

TABLE 10.—*Age Distribution of Cases in Which Chills Occurred Before Surgical Treatment*

9 mo. to 10 Yr.	11 to 20 Yr.	21 to 30 Yr.	31 to 40 Yr.	41 to 50 Yr.	51 to 63 Yr.
37 cases	15 cases	6 cases	3 cases	..	2 cases

patients had chills preceding their septic temperature, and he stated that this was noted particularly in the younger patients, despite the fact that chills are not so commonly expected in the very young.

It is interesting to note that 33 patients had one or more chills postoperatively.

There were 5 patients who had one or more chills postoperatively who had had none preoperatively.

The patient in case 16 had an organizing obturating thrombus in the lateral sinus and had a chill two days after operation–ligation. The patient in case 36 had a chill three days after operation–ligation; the next day revision of the operation was performed, and at this time pus was washed out of the bulb. The patient died

TABLE 11.—*Age Distribution of Cases in Which Chills Occurred After Surgical Treatment*

9 mo. to 10 Yr.	11 to 20 Yr.	21 to 30 Yr.	31 to 40 Yr.	41 to 50 Yr.	51 to 63 Yr.
17 cases	8 cases	5 cases	2 cases	..	1 case

twenty-two days after mastoidectomy and six days after operation–ligation, of uncontrolled bacteremia. The sinus bled profusely, there was no demonstrable thrombus and no specimen of the wall of the lateral sinus was taken. In case 87 chills persisted after operation, and an infected thrombus was demonstrable even below the point of resection of the internal jugular vein and part of the innominate vein. Pathologic examination of the excised portion of the vein in that the extensive resection still did beyond the area of thrombophlebitis. The also had extension of the thrombophlebitic to the torcular Herophili and died of men In case 89 the chills were explainable on th of an infected thrombus in the internal vein which extended up and involved th The patient had two revisions of the operation and only after the third operat which time a thrombus was removed fr internal jugular vein and one from the t end of the sinus, did the chills cease and th cultures ultimately become sterile. In case patient had a chill one day after operation tion, at which time an obturating thromb removed. Two days after the original tion, a revision was performed. At this with removal of the plug from the region superior petrosal sinus, about a teaspoo pus welled out of the sinus, following whic

TABLE 12.—*Data on Cases in Which Chills Not Occur Preoperatively But Occurred Postoperatively*

Case	Age of Patient, Yr.	Histologic Observations on Specimen Obtained at Operation	Time of Chill
16	9	Organized obturating thrombus in vein	2 days after operation
36	3	Pus could be irrigated from bulb	3 days after operation
87	15	Obturating thrombus from neck to torcular end	10 days after operation
89	21	Purulent thrombus from vein	Repeated chills
82	16	Obliterating thrombus in vein	1 day after operation

were no more chills. A metastasis deve in the hip, which subsided.

It is noteworthy that in all of the 5 case described there were positive blood cu before operation, and in all obturating th were found; in 1 there was pus in the bul

Comment.—Chills occurred preoperative 63 of the 100 cases in this series. The occur of chills is significant and of considerable i tance diagnostically. On the basis of a stu 150 cases of sepsis, Neuhof [33] said that are probably absolute evidence of the in of the blood stream by bacteria. He held they constituted one of the most characte clinical features and that they were prese less than half of his cases. It cannot be said the absence of chills militates against the nosis of infection of the lateral sinus. Resis on the part of the host to the general invasi

31. Portmann, G.: Traitement chirurgical des phlébites et thrombo-phlébites sinuso-jugulaires, J. belge de neurol. et de psychiat. **34**:211-217 (April) 1934.

32. Greenfield, S. D.: Thrombophlebitis of the Lateral Sinus: Observations in a Series of Twenty-Two Cases, Arch. Otolaryng. **25**:661-683 (June) 1937.

33. Neuhof, H.: Radical Operative Treatment Suppurative Phlebitis and Its Results, Ann. Surg. 201-204 (Aug.) 1941.

ria and to their toxins is often responsible shaking chill. One of the explanations d for the absence of chills in thrombophle- of the lateral sinus is that both ends of the bus are sterile.

cording to Gill,[34] true chills are present in han 50 per cent of the cases. Tobey[35] ted that true rigors occurred in less than r cent of the cases, though a large majority patients complain of fleeting chilly sensa- accompanied by sweating. Politzer[36] stated hills were much more common in the late s of the disease, at which time several chills often observed daily. Chills were noted by of with the same relative frequency in pa- with and patients without metastatic s. Absence of chills does not mean lowered lity, particularly since it is known that es or other debilitating states may be s in suppression of symptoms despite exten- disease in the lateral sinus. Furthermore, acteria entering the circulation at a steady may not cause sufficient reaction on the part body and hence no chill. The ability of ody to destroy bacteria has been definitely d by Libman and Celler[37] and Ottenberg[38] thers.

this series the incidence of chills has been r than that usually reported, and the rela- high incidence in children is worthy of

METASTASES

this series of 100 cases, metastases were clinically before obliteration of the lateral and ligation of the internal jugular vein in tients. There were 22 patients who showed nce of a metastatic focus after operation. hese 22 patients, 9 had other clinical metas- before operation. If these 9 are not in- d, it appears that there were 13 in whom stases occurred after operation. There is justification for this, because metastases are down during the period of bacteremia and become clinically evident hours and days

e infective organisms may be deposited in us parts of the body with the original inva- sion, and there may be an interval of hours or many days between the clinical appearance of a metastasis and the time the organisms were originally deposited. Fenton,[39] Friesner,[10] Tobey[35] and many others subscribe to this belief. Tobey said that physical signs of a metastasis which has occurred before or immediately after ligation may be delayed for several days. For this reason he held that it is illogical to attempt to state definitely that metastatic foci which appear clinically twenty-four to seventy-two hours after the surgical procedure are related to it and to use this as an argument against ligation of the jugular vein.

Vague signs suggesting pneumonitis, which prompted roentgen examination of the chest, were present preoperatively in 9 cases. Postoperatively pulmonary signs and symptoms were present in 10 cases. The pulmonary manifestations of a metastatic focus may simulate the ordinary pneumonic infiltration. In most instances the roentgenograms of the chest when taken revealed no pathologic process. Metastases may occur anywhere in the body. They were noted in and about the hip, the shoulder, the elbow, the foot, the lung (cortical abscess), the sternoclavicular joint, the soft parts and the spinal column.

Metastases in the joints are more frequently periarticular than intra-articular. One has only to recall that such metastatic foci arise through deposition of particulate matter (cocci) carried by the blood stream and that the intra-articular circulation of blood is scant to understand why metastasis about the joint is more common than suppuration in the joint. In children the hip joint seems to be the site of predilection. When the bacteremia is controlled, suppuration in a joint (proved by aspiration) and osteomyelitic lesions have subsided spontaneously. Whether this is due to immune reaction or to lessened bacterial virulence or to both cannot be definitely stated.

Haymann[40] reported a metastatic focus in a cervical vertebra. This is an infrequent location for one. I recall a patient admitted to the Mount Sinai Hospital from another institution, with type III pneumococcus bacteremia, who had a metastasis in the dorsal part of the spinal column which required incision and drainage. Type III pneumococci were recovered from the pus. Evidence of recanalization was observed during

Gill, E. G.: Thrombosis of the Lateral and nous Sinuses Complicating Acute Mastoiditis, Tr. Laryng., Rhin. & Otol. Soc. **32**:15-21, 1926.

Tobey, G. L.: Lateral Sinus Infection, Tr. Am. ng., Rhin. & Otol. Soc. **27**:201-213, 1921.

Politzer, A.: A Textbook of the Diseases of the Philadelphia, Lea & Febiger, 1926.

Libman, E., and Celler, H. L.: Importance of d Cultures in Study of Infections of Otitic Origin, J. M. Sc. **138**:409-427 (Sept.) 1909.

Ottenberg, R.: The Rate and Location of Re- l of Bacteria from the Blood in Human Disease, Path. **11**:766-774 (May) 1931.

39. Fenton, R. A.: Lateral Sinus Thrombosis with Delayed Metastasis, Ann. Otol., Rhin. & Laryng. **36**: 657-677 (Sept.) 1927.

40. Haymann, L.: Seltene Lokalisation einer Metastase nach Sinusthrombose, Ztschr. f. Laryng., Rhin., Otol. **23**:73-74, 1932.

operation on the lateral sinus. In this patient amyloidosis developed as a result of the prolonged suppuration.

Pleuropulmonary metastatic suppurations have been reported by Lillie,[41] Boies,[42] Rosenwasser [43] and others. In view of the fact that huge numbers of organisms pass through the pulmonary bed, it is surprising that pulmonary suppuration is not more common.

A toxic psychosis may occasionally be encountered, and one must bear in mind that this state may mask or be the representation of a cerebral metastasis. In case 32 a toxic psychosis developed which was manifested in self mutilation; the patient bit off a large segment of his lower lip. Less commonly noted metastatic lesions are thyroiditis (Collet [44]), endocarditis (Libman [45]; Rosenwasser [29]), ophthalmia (Sommer [46]) and carbuncle of the kidney. As stated in previous communications,[47] my associates and I have not seen infectious embolic lesions on the arterial side of the circulation, and we utilize this clinical observation in differential diagnosis when necessary.

Comment.—My material indicates that there was no significant increase in the number of metastatic foci in the cases in which ligation of the internal jugular vein was performed together with obliteration of the sinus. It must be borne in mind and emphasized that not infrequently ligation of the internal jugular vein was performed (when not done with the obliteration of the sinus) when the clinical course of the patient was not satisfactory. To paraphrase this, frequently after obliteration of the lateral sinus, bacteremia persists. All other possible causes of bacteremia having been ruled out, a revision of the original operation is carried out. The internal jugular vein is ligated. The torcular and bulbar ends are inspected — if possible, beyond the thrombophlebitic area. The continuation or recrudescence of symptoms of sepsis after operation, Tobey stated, forces one to consider first the possibility of metastasis, which may have occurred before or immediately after ligation, the physical signs of which may be delayed for several days.

PAPILLEDEMA

Changes in the ocular fundus have been described frequently as a fairly common accompaniment of thrombosis of the lateral sinus. Early reports, in which the figures for incidence vary, were recorded by Kipp [48] (1879), Jansen [49] Ruttin [50] (1911), Dench [51] (1912), Tobey (1921), Atkins [52] (1924), Eves [53] (1925), White [54] (1925), Benedict [55] (1931), Eagelton [56] and Friesner [57] (1941). According to Tobey, optic neuritis or choked disk may be present in a small percentage of patients, 10 to 11 per cent, and he expressed the belief that it is due to meningeal irritation and infection or to extension of the thrombus and consequent blocking of the petrosal sinuses.

In this analysis I refer to papilledema in the manner of White, namely, with a view to the changes in the optic nerve which are marked enough to be recognized clinically. In an analysis of 62 cases he reported that the fundi were normal in 29; that dilatation of the retinal veins appeared in 4; blurring of the margin of the disk in 13; slight papilledema in 8, and marked papilledema in 8. He concluded that papilledema

41. Lillie, H. I.: Suppuration of the Temporal Bone Accompanied by Infection in the Blood Stream: A Clinical Study, Arch. Otolaryng. **18**:630-642 (Nov.) 1933.

42. Boies, L. R.: Lateral Sinus Thrombosis: Review of 184 Cases, Ann. Otol., Rhin. & Laryng. **41**:227-237 (March) 1932.

43. Rosenwasser, H.: Unusually Early Pleuro-Pulmonary Suppuration in Sinus Thrombosis, Laryngoscope **46**:519-522 (July) 1936.

44. Collet, F. J.: Thyroïdite suppurrée compliquant une phlébite du sinus latéral, Lyon méd. **143**:673-676 (June) 1929.

45. Libman, E.: A Further Communication on the Importance of Blood Cultures in the Study of Infections of Otitic Origin, Tr. Internat. Otol. Cong. **9**:127-176, 1912.

46. Sommer, I.: Ueber metastatische Ophthalmie bei otogener Sinusthrombose, Monatschr.f.Ohrenh. **63**:419-427 (April) 1929.

47. Rosenwasser.[29] Friesner and others.[25]

48. Kipp, C. J.: Four Cases of Intracranial Disease Caused by Chronic Suppuration of the Middle Ear, Arch. Otol. **8**:147-164, 1879.

49. Jansen, A.: Ueber Hirnsinusthrombose nach Mittelohreiterungen, Arch. f. Ohrenh. **36**:1-54, 1894.

50. Ruttin, E.: Ueber Stauungspapille bei otogenen Komplikationen, Verhandl. d. deutsch. otol. Gesellsch. **20**:369-376, 1911.

51. Dench, E. B.: The Differential Diagnosis between Brain Abscess and Sinus Thrombosis and the Treatment of These Conditions, Therap. Gaz. **28**:535-543 (Aug. 15) 1912.

52. Atkins, R. T.: Report of Forty Cases of Lateral Sinus Thrombosis, New York State J. Med. **24**:885-890 (Oct.) 1924.

53. Eves, C. C.: The Diagnosis of Lateral Sinus Thrombosis, Ann. Otol., Rhin. & Laryng. **34**:1082-1095 (Dec.) 1925.

54. White, L. E.: Papilledema of Otitic Origin, Arch. Otolaryng. **2**:371-378 (Oct.) 1925.

55. Benedict, W. L.: Cranial Sinus Thrombosis: Ophthalmologic Aspects, Surg., Gynec. & Obst. **52**:464-470 (Feb., no. 2 A) 1931.

56. Eagelton, W. P.: Brain Abscess: Its Surgical Pathology and Operative Technique, New York, The Macmillan Company, 1922.

57. Friesner, I.: An Analysis of the Ocular Fundus Changes in Otitic Sinus Thrombosis, Ann. Otol., Rhin. & Laryng. **50**:32-37 (March) 1941.

en present with thrombosis of the lateral sinus a valuable diagnostic aid but that its absence s not exclude an intracranial complication. cording to Sutphen,[58] changes in the fundus apparent in 1 of every 5 cases of sinus throm- sis. The changes have occasionally been ssified as occurring before operation and liga- n in contrast with those occurring after opera- n. According to Friesner,[57] this is an itrary division since he is not at all sure that eration per se plays any significant role in the velopment of papilledema.

In the present series changes in the fundus re noted before obliteration of the lateral sinus d ligation of the jugular vein in 24 patients; ad papilledema of from 1 to 3 diopters, 14 had rring of the margin of the disk, and 5 dilata- n of the retinal veins or hyperemia of the nerve ad.

After obliteration and ligation, definite pap- dema of varying degree was observed in 23 ients. In 15 some blurring of the margin the disk was noted, and in 4 of these there o were flame-shaped hemorrhages. Changes the fundus were observed to be present from to seventy-one days after operation. In ny instances the slightest changes in the dus were noted preoperatively, and despite sation of all manifestations of bacteremia, re was noted a definite advance in the degree papilledema, in many instances lasting days d weeks.

In some cases changes in the fundus occurred the first time weeks after, and in other tances before, operation and ligation. It seems me that if obliteration of the sinus and ligation the jugular vein were the main factor, the nges in the fundus should take place soon r these operations, before the collateral cir- ation has the necessary time to adjust and care the return circulation.

Comment.—As pointed out by Friesner [57] and stantiated again by this study,

> there was no definite parallelism between the e of the fundi and the condition of the patient at given time. In some the eye-ground changes were gressive long after the patient was well enough to at home, while in others there was improvement in fundi even though the patient was still quite sick.

ere was no significant correlation between normal changes in the fundus and the severity the otitic sepsis.

The precise mechanism of the development of changes in the fundus is not known. To all the suggested mechanisms ([1] stasis, [2] reased intracranial pressure, [3] toxic state, [4] anomalies) objections can be found. Dean [59] stated that for twenty-five years he observed the fundi in every case of accidental opening of the lateral sinus, which was packed to control hemorrhage. In none of these cases did he note any evidence of papilledema from blocking of the circulation in an uninfected sinus. I recall a patient in whom the sigmoid sinus was accidentally injured. On the fifth postoperative day the patient had a chill with a rise in temperature to 105 F. The temperature came down promptly the same day, and the patient made an uneventful recovery. No changes in the fundus developed.

According to Friesner:

> The cranial sinuses are part of the dura, and the one factor which is common to all of these cases is, therefore, an inflammation of the dura. It is possible that the latter with its attendant edema and infiltration may be an important factor in the development of papilledema with sinus thrombosis.

MORTALITY

Death occurred in 27 of the 100 cases reviewed in this series, and table 13 indicates the distribution of these cases in the age groups. The greater mortality in patients past 30 years of age as compared with children is striking. Many authors have stated that for patients over 16 years of age ill with thrombophlebitis of the lateral sinus, the prognosis is graver than for a younger age group. Portmann [31] reported that there had been no deaths among his patients during an eight year period, and he explained his excellent results on the basis of prompt surgical intervention with regard to both the lateral sinus and the internal jugular vein.

TABLE 13.—*Age Distribution of Cases in Which Death Occurred from Thrombophlebitis of the Lateral Sinus*

9 mo. to 10 Yr.	11 to 20 Yr.	21 to 30 Yr.	31 to 40 Yr.	41 to 50 Yr.	51 to 60 Yr.	61 to 70 Yr.	Total
14 in 55 cases	7 in 26 cases	1 in 9 cases	1 in 3 cases	1 in 2 cases	2 in 3 cases	1 in 2 cases	27 in 100 cases

In table 14 the age of the patient, the causative organism, the pertinent operative observations and the cause of death in these 27 cases are listed.

A bad prognosis is indicated if the thrombus has descended deep into the internal jugular vein or has extended into the torcular Herophili. The clinical condition of the patient and the possibility of eradicating the focus from which the organisms are escaping into the blood stream are better

58. Sutphen, E. B.: Complications of Mastoiditis, J. Soc. New Jersey **24**:627-629 (Nov.) 1927.

59. Dean, L. W.: Panel Discussion on Lateral Sinus Infections: Papilledema, Tr. Am. Otol. Soc. **30**:105, 1940.

TABLE 14.—*Data on Cases in Which Death Occurred from Thrombophlebitis of the Lateral Sinus*

Case	Age, Yr.	Bacteriologic Findings	Operative Observations, Clinical Course, Cause of Death
20	63	Pneumococcus type III	Thrombophlebitis from bulb to torcular Herophili, extending over to opp lateral sinus. Despite revision of operation and chemotherapy, this patient, ill severe diabetes, died of suppurative meningitis 26 days after mastoidectomy operation on the lateral sinus
23	17	Str. haemolyticus, beta type	Petechiae noted after operation on the sinus; the patient had acute rhe endocarditis. Sinus wall showed "thrombophlebitis." Death 9 days after ma dectomy and 3 days after operation on the sinus
25	5½	Str. haemolyticus, beta type	After obliteration of sinus and ligation of internal jugular vein, focal neu developed. Patient died of suppurative meningitis 19 days after operation on sinus and 24 days after mastoidectomy
32	14	Str. haemolyticus, beta type	Bacteremia controlled after operation; there were many metastases. A huge ab about head of great trochanter was drained; Dakin tube in femoral wound. Pa died of hemorrhage from deep femoral artery 8 weeks after obliteration of s and ligation of vein
35	36	Str. haemolyticus, beta type	Purulent thrombophlebitis involving bulb and torcular end of sinus; pus welle from bulb. Patient had meningitis on admission and died of suppurative me gitis. NOTE: At time of original mastoidectomy sinus and dura were expose search for cause of meningitis; none found. Undoubtedly at that time, 1 week be sinus-jugular vein operation, patient already had sinus thrombosis
36	3	Str. haemolyticus, beta type	Sinus bled profusely when opened 12 days after mastoidectomy; revision of op tion revealed pus from bulb; 4 days later signs of meningitis developed, patient died 10 days after original sinus-jugular vein operation
37	11	Anaerobic Str. haemolyticus	Necrotic internal jugular vein excised down to clavicle 7/13. Broken-down thro with foul odor removed from lateral sinus 7/14. Patient died night of opera from sepsis and shock
43	6	Str. haemolyticus, beta type	Patient admitted disoriented, delirious; temperature 105.2 F. Lumbar tap prod clear fluid under markedly increased pressure; cell count, 15. Blood culture pos 2 days later. Mastoidectomy and operation on sinus and jugular vein; organi thrombus removed; no bleeding from bulb. Patient had shaking chill after op tion, and temperature rose to 109 F. Despite ice packs and antipyretic ther patient died 8 hours after operation
44	10	Str. haemolyticus, beta type	Six weeks of disease of ear; mastoidectomy 5/11; operation on sinus and jug vein 5/17; free bleeding. Revision done 5/20; pus from bulb. Patient die meningitis 5/28
46	6	Str. haemolyticus, beta type	Convulsion lasting 30 minutes 5 days before admission. Measles otitis with pos blood culture 4/4. Internal jugular vein ligated 4/5, sinus being obliterated; general condition of patient became bad, operation was discontinued. Thick pu mastoid cells; thrombus in sinus. After operation, patient had four convul attacks in 12 hours and died 17 hours after operation. Autopsy revealed a Rathke pouch cyst. (The patient had undergone removal of pituitary cys interpeduncular space 2 years before.)
55	45	Str. haemolyticus, beta type	Radical mastoidectomy 11/3; bacteremia proved; sinus-jugular vein operation 4 days after latter, evidence of suppurative meningitis. NOTE: 1 week after ra mastoidectomy, frontal headache developed and temperature rose to 104.2 F. bleeding from bulb but no thrombus demonstrable
62	9 mo.	Str. haemolyticus, beta type	Mastoidectomy 3/15; sinus-jugular vein operation 3/20; internal jugular vein gre and filled with purulent thrombus; it was resected close to subclavian vein; pu sinus. After operation, temperature rose to 108.6 F., and patient died 12 h after operation
65	5	Str. haemolyticus, beta type	Mastoidectomy 5/29; sinus-jugular vein operation 6/9; infected thrombus; no bl ing; only slight bleeding from torcular end. Chills, fever and positive blood cul persisted. Patient died of meningitis 17 days after operation on sinus and 28 d after mastoidectomy
66	5	Bacillus pyocyaneus	Mastoidectomy 4/19; blood culture positive for B. pyocyaneus 4/24. Repeated c before and after mastoidectomy, with temperature of 105 F. Sinus-jugular operation 4/27; thrombus removed. NOTE: This patient was operated on w temperature was 107 F. and bled profusely from region of bulb. These factors, I believe, caused the patient to go into shock and die on operating t
70	8	Str. haemolyticus, beta type	Mastoidectomy done on right side at another hospital; 10 days later, after get up, patient had fever, chills and hematuria. Day after admission, 8/11, had p tive Ottenberg blood culture in all flasks. Operation on sinus 8/12; because ears were discharging, both lateral sinuses were looked at; both appeared h both were aspirated and blood readily obtained from both. Neither sinus obliterated; jugular vein was not ligated. After operation septicemia persi with chills, temperature 107 F. and persistently positive blood culture. Transfu given. Signs of meningitis occurred, and patient died 8/18, 5 days after explo tion of sinus. Autopsy revealed necrotic suppuration in bulb and red thrombu right lateral sinus, meningitis and suppurative lymphangitis, acute diffuse n erular nephritis and parenchymatous degeneration of all the viscera
72	10	Anaerobic Str. haemolyticus	After three negative blood cultures, anaerobic Str. haemolyticus was isolated Sinus-jugular vein operation 6/23; sinus appeared normal except near bulb, wh it was brownish; free bleeding; no thrombus demonstrable. Transfusion gi Meningitis developed, and patient died 6 days after operation
73	11	Str. haemolyticus, beta type	Sinus-jugular vein operation 5/16; free bleeding; no thrombus. Septicemia c tinued. Revision of operation 5/22; no bleeding from bulb or torcular end. this time patient had meningitis, and 3 days after the original sinus-jugular op tion he died
76	25	Str. haemolyticus, beta type	Mastoidectomy 1/28. 2/2 sepsis noted and blood culture positive for Str. hae lyticus, beta type: colonies too numerous to count. 2/4 sinus-jugular vein op tion; purulent exudate in sinus; free bleeding from sinus spontaneously. Se cemia continued. 2/6 revision of operation on sinus; pus welled up from the b Despite this septicemia continued. Resection of jugular vein 2/11; pus and throm in vein below ligature; wide resection from subclavian vein to superior bulb. Des this, patient died of meningitis 16 days after sinus-jugular vein operation
77	12	Str. haemolyticus, beta type	Mastoiditis 3/3 followed by sepsis and positive blood culture. Spinal tap reve Str. haemolyticus, beta type. 3/10 sinus-jugular vein operation; sinus bulb filled with purulent thrombus; free bleeding from torcular end. Meningi persisted, and patient died 8 days after this operation and 15 days after mas dectomy. NOTE: Headache, which was severe before mastoidectomy, was influenced by either mastoidectomy or obliteration of sinus

LE 14.—*Data on Cases in Which Death Occurred from Thrombophlebitis of the Lateral Sinus—Continued*

Age, Yr.	Bacteriologic Findings	Operative Observations, Clinical Course, Cause of Death
8½	Str. haemolyticus, beta type	Mastoidectomy done at another hospital. Evidence of nephritis on admission; chill; blood culture with Str. haemolyticus, beta type, 12/6. 12/6 revision of mastoidectomy and sinus-jugular vein operation; infection with numerous undrained cells present; no bleeding from bulb; obturating thrombus present; pus and thrombus in emissary vein; superior petrosal sinus thrombosed. Patient died of meningitis 15 days after admission. NOTE: Autopsy revealed organizing thrombus extending into torcular Herophili, superior longitudinal sinus and left lateral sinus, thrombosis of cerebellar veins and basilar meningitis. Operation, subdural drainage, lumbar puncture, laminectomy, transfusion, all were of no avail
15	Str. haemolyticus, beta type	1/13, mastoidectomy. 1/16, blood culture positive for Str. haemolyticus, beta type. 1/17, 2½ inch portion of internal jugular vein resected and found to contain purulent thrombus; operation on sinus with obturating thrombus from bulb to transverse sinus, but septicemia persisted. 1/20, internal jugular vein resected to root of neck; thrombus found (Dr. Neuhof); specimen showed "thick wall of edematous vein with intima apparently free of involvement except at site of adherent thrombus; latter was about 1 inch long and apparently complete above and below; it tapered off to a narrow projection below; above it was dome shaped." 1/27, chill which lasted 20 minutes. 1/28, because histologic section showed that limit of the phlebitis, resection of the right innominate vein was carried out by Dr. Neuhof. 1/30, blood culture was sterile. 2/5, blood culture positive for Str. haemolyticus, beta type. Patient died of meningitis
60	Anaerobic streptococcus	Patient diabetic, admitted with meningitis; cell count on spinal fluid 6,900; since childhood had chronic suppuration of middle ear (56 years). 1/22, exploratory mastoidectomy; pus found draining through dura, coming from foul-smelling abscess of temporal lobe. 1/24, blood culture positive for anaerobic Str. haemolyticus. Meningitis and septicemia persisted; metastatic foci in lungs. 1/27, sinus-jugular vein operation; pathologic report of inflamed sinus wall with parietal thrombus. Patient died of meningitis. Autopsy revealed: abscess cavity containing greenish pus occupying almost entire temporal lobe; meningitis; lateral sinus filled with adherent thrombus almost to torcula; necrotic anaerobic abscess of lung; thrombus in pulmonary artery; infarction of lower lobe of right lung; diabetes mellitus
18	Str. anhaemolyticus	Patient admitted to medical service 3/18; septic course and positive blood culture. 3/25, mastoidectomy and sinus-jugular vein operation; no pus in mastoid cells; broken-down thrombus removed from lateral sinus; internal jugular vein ablated; pathologic specimen revealed thrombophlebitis. While being given a transfusion immediately after operation, patient died. Postmortem observations were negative except that thrombus was still present posterior to plug in area of knee of sinus
35	Pneumococcus type III	Postmortem examination revealed early abscess of brain and meningitis as cause of death, with status after bilateral mastoidectomy for pneumococcus type III infection, and thrombosis of right lateral sinus
10	Str. haemolyticus, beta type	Patient died of terminal meningitis. Specimen from sinus revealed phlebitis with adherent organized thrombus
9	Str. haemolyticus, beta type	Patient had mastoidectomy at our hospital 6 months before admission. 4/13: Evidence of sepsis and blood culture positive. 4/19, obliteration of sinus and ligation of jugular vein; infected thrombus removed from sinus. Day after operation patient suddenly had bloody froth at mouth, pulse became imperceptible, and death occurred within one-half hour. Permission to examine only head was obtained; there was parietal thrombus in bulb; no evidence of abscess of brain (lumbar puncture had given negative results); no meningitis. Cause of sudden death not definitely determined
6½	Str. haemolyticus, beta type	Admitted 2/27 with history of having been observed on pediatric service from 1/28 to 2/17. Evidence of sepsis; chills; positive blood culture; high fever (105 F.); headache. 3/11, obliteration of sinus and ligation of jugular vein; both mastoid processes explored; both lateral sinuses aspirated; no blood in left sinus; thrombus evacuated from left sinus. NOTE: Headache persisted after operation. 3/30, patient suddenly became worse, with signs of abscess of brain. 4/3, cerebellum aspirated; no abscess encountered. 4/21, signs pointing to abscess in temporosphenoidal lobe; at operation (Dr. Friesner) about 75 cc. thick greenish pus evacuated. Patient improved for short while, then again became stuporous and died of meningitis and abscess of brain

s to the prognosis than the number of ies in a positive blood culture.

ree patients died of abscess of the brain meningitis. Four patients had meningitis on ssion, 1 of whom was among the 3 who of abscess of the brain. Three patients died perpyrexia shortly after operation. It is rally agreed that it is better to postpone cal intervention for a few hours or even a nd to institute general supportive measures, as transfusions and continuous intravenous py, until improvement in the general con- n of the patient is evident. Furthermore, I not hesitated to stop at any stage of the ation if the general condition of the patient ot warrant continuance.

the reported statistics the number of deaths widely. Boies [42] reported a mortality of 25 per cent, adding that 18 patients admitted to the hospital, hopelessly ill, were excluded from his series. Meltzer [5] reported the mortality in one series of cases (1921 to 1926) to be 31.3 per cent and that in the second series (1926 to 1932) to be 25.8 per cent. Behrman [60] reported a mortality of 32 per cent, declaring that in 65 per cent of his cases the thrombophlebitis of the lateral sinus developed after acute purulent otitis media. Maxwell [61] reported a mortality of 36.5 per cent with no cases excluded. Lillie [41] re-

60. Behrman, W.: Sinus Thrombosis Material of Sahlgren Hospital, 1910-1936, Acta oto-laryng. **25**:534-540, 1937.

61. Maxwell, J. H.: Thrombosis of the Sigmoid Sinus: A Clinical Analysis, Arch. Otolaryng. **25**:184-189 (Feb.) 1937.

ported a mortality of 16.3 per cent, Juers [62] 24 per cent and Greenfield [32] 13.5 per cent. Evans [63] in an extensive review of the mortality statistics, compiled from all over the country, stated that simplification would result if the figures always reported mortality exactly as it occurs, without any attempt to make the record in certain series look more favorable by exclusion of some cases.

Seydell [64] declared that statistics vary as to whether thrombosis of the lateral sinus is associated more frequently with acute or with chronic suppuration of the middle ear. The acute exacerbation of chronic suppuration of the middle ear plays a very important role in the production of intracranial complications. In almost all of the larger series of cases reported, the mortality ranged from 30 to 40 per cent. The experience at the Mount Sinai Hospital is similar to that of Haymann,[2] Boies,[42] Maxwell,[61] Wanamaker,[65] Behrman [60] and Coates, Ersner and Persky [9] that the incidence of thrombosis of the lateral sinus was much higher in cases of acute suppuration but that the mortality was greater in cases of chronic suppuration of the middle ear. On the other hand, Ruegg [66] reported a series of 81 cases, in 43 of which the thrombosis occurred with acute infection and in 38 with chronic infection of the mastoid process. Brunner [67] found that in 12 of 22 cases the thrombosis followed acute, and in 10 cases chronic, infection of the mastoid process. I am in accord with the point of view of Maxwell, who declared that there is a direct relation between the mortality rate and the duration of the preoperative period of bacteremia, and this is borne out by the present analysis. In the treatment of sepsis, as a general rule, the best results can be anticipated in cases in which the invasion is in a relatively early stage.

INFLUENCE OF CHEMOTHERAPY

Nineteen patients included in this series of 100 cases were given sulfanilamide or its derivatives postoperatively. The age group was from 23 months to 63 years. One patient (case 14), in whom agranulocytosis and toxic hepa developed, recovered after cessation of chemotherapy and with repeated blood tr fusions. One 63 year old diabetic pat (case 20) died of Pneumococcus type meningitis. At postmortem examination thrombus had extended to the torcular Hero and involved the opposite lateral sinus. Ano patient (case 9), aged 44 years, with ma hyperthyroidism, was admitted with right sph ethmoiditis, which required sphenoethmoi tomy. As a sequel to this, acute mastoi developed. During the mastoidectomy the lat sinus was injured, and five days later bacteremia developed. This patient was un to tolerate any of the sulfonamide drugs died of suppurative meningitis.

TABLE 15.—*Data on Cases in Which Chemother Was Used*

Case	Age of Patient	Days Chemotherapy Was Given (Total)	Metastases: Preoperative	Metastases: Postoperative	Outcom Pati
2	14 yr.	13	None	None	Recov
3	23 mo.	17	Chest	None	Recov
4	38 yr.	17	None	None	Recov
5	53 yr.	5	Chest	None	Recov
6	13 yr.	11	Chest ?	None	Recov
7	16 yr.	20	Ulna	Rt. shoulder, soft parts; arm	Recov
8	21 yr.	17	None	None	Recov
9	44 yr.	3	None	None	Died
10	13 yr.	27	Kidney	None	Recov
11	10 yr.	13	None	None	Recov
12	7 yr.	23	Chest ?	None	Recov
13	24 yr.	7	None	None	Recov
14	5 yr.	21	Hip	Rt. elbow	Recov
15	3½ yr.	3	None	None	Recov
16	9 yr.	9	Rt. hip; chest	Elbow, soft parts	Recov
17	4½ yr.	20	None	None	Recov
19	8 yr.	21	None	None	Recov
20	63 yr.	13 and again 2 wk. later	Chest	None	Died
29	16 yr.	19	Sterno-clavicular joint	None	Recov

According to Galloway,[68] thrombosis of lateral sinus can probably be dealt with suc fully without chemotherapy if necessary. stated that chemotherapy seemed to hasten and prevent the danger of local and ge spread of sepsis. Cunning [69] stated that ch therapy is a great help but that it must n depended on to take the place of surgical t ment; rather it should be employed as a valu adjunct to that treatment. A word of ca was sounded by Cirillo [70] in discussing the

62. Juers, A. L.: Otitic Sepsis, Arch. Otolaryng. **27**:178-188 (Feb.) 1938.

63. Evans, W. H.: Thrombosis of Lateral Sinus: Survey of Current Opinion and Records, Arch. Otolaryng. **28**:959-986 (Dec.) 1938.

64. Seydell, E. M.: Sinus Thrombosis, Ann. Otol., Rhin. & Laryng. **41**:466-491 (June) 1932.

65. Wanamaker, T. T.: Some Consideration and Suggestions in Handling of Lateral Sinus Thrombosis, Laryngoscope **40**:787-798 (Nov.) 1930.

66. Ruegg, K.: Beitrag zur Frage über Häufigkeit und Vorkommen otitisher Hirnkomplikationen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:345-347 (Dec.) 1927.

67. Brunner, H.: Post-Operative Sinus Thrombosis. Arch. Otolaryng. **10**:217-237 (Sept.) 1929.

68. Galloway, T. C.: Chemotherapy, Arch. laryng. **30**:901-915 (Dec.) 1939.

69. Cunning, D. S.: Chemotherapy of Disease the Nose and Throat, Arch. Otolaryng. **36**:60 (Oct.) 1942.

70. Cirillo, A. A.: Masking of Pathologic Stat Otitis Media by Chemotherapy, Arch. Otolaryng 541-547 (Oct.) 1942.

riminate use of chemotherapy. He declared:

ce the advent of chemotherapy my associates and
e observed that the classic signs and symptoms of
thrombosis are often disguised so as to render
sitive diagnosis difficult. The promiscuous use of
otherapy in cases of otitic infection tends to delay
ate diagnosis and surgical intervention. The de-
n surgical intervention accounts for the increased
ality in the cases of complications of otitis media
dly noted in our experience.

believed that chemotherapy could not replace
ical treatment if an undrained necrotic focus
still present. Walsh [71] quoted the experi-
of Hartman, who had noted a reduction in
mortality of patients with thrombosis of the
al sinus from 35 to 10 per cent since the use
hemotherapy. Boies,[72] in a report based on
dy of his private patients, obtained a 4.4 per
mortality when chemotherapy was employed,
pared with 19 per cent before it was avail-
Neuhof [33] expressed the belief that the
ence of chemotherapy on pyogenic sepsis
o profound and so many extraordinary
veries take place that there is almost an
oidable tendency to await the effect of
notherapy alone in any case of sepsis. He
er stated that until evidence to the con-
is advanced, one must assume that bac-
nia due to suppurative phlebitis will or may
ist despite chemotherapy, and therefore sur-
measures for the eradication of the phlebitic
s are warranted.

the 19 cases reported in the foregoing
s chemotherapy was usually begun after the
nosis was established. It was begun just
re operation and maintained after operation
ng as the clinical course justified its use.
ppears that in this small group of cases the
l surgical treatment of the thrombosis com-
d with chemotherapy offers a substantial
of diminishing the mortality and the mor-
y from this serious disease. I have purpose-
refrained from formulating a percentage
tality because from a statistical point of view
computation of mortality based on small num-
of cases is not accurate and is apt to be
eading. Only when large series of cases are
able and like data are compared, with con-
ation being given all the factors which in-
ce mortality, will it be statistically possible
rmulate an accurate rate.

SUMMARY

he results of an analysis of 100 cases of
mbophlebitis of the lateral sinus in which
the sinus was operated on at the Mount Sinai Hospital, New York, may be summarized as follows:

1. The ages of 55 patients ranged up to 10 years; the ages of 90 were under 30 years.

2. An obturating thrombus was present in the lateral sinus in 12 of the 27 patients who died; 15 patients had "suppurative thrombophlebitis" or "mural thrombus" or "phlebitis." In this analysis, it was not possible to correlate the pathologic material prognostically with the clinical course.

3. Positive blood cultures were obtained preoperatively in 80 of the 97 cases in which blood was taken. In 36 of these 80 cases one or more positive blood cultures were obtained postoperatively. They were obtained from one to twenty-four days after operation, and twenty-five of them were obtained within the first seven postoperative days. The greatest expression of the pathologic process was in or about the bulb of the internal jugular vein, and in 9 cases there actually was pus within the bulb.

Negative blood cultures were obtained preoperatively in 17 cases, and in 8 of these positive cultures were obtained from one to forty-two days postoperatively. In 6 of these 8, however, the positive cultures were obtained within the first eight days after operation.

4. Sixty-three patients had one or more chills preoperatively. (It is interesting to note that 37 of these were patients 10 years of age or younger.) Thirty-two patients had one or more chills postoperatively.

5. The time at which a metastatic focus becomes clinically evident is no reliable indication as to when the bacteria were deposited. In this study, metastases were noted preoperatively in 21 patients, whereas metastases were observed postoperatively in 22 patients. Of the latter, 9 also had clinical metastases before the operation on the sinus and jugular vein.

6. Changes in the ocular fundi were observed before operation in 24 patients, whereas they were noted postoperatively in 38 patients. Evaluation of the material indicated that it was not possible to correlate consistently the appearance of the fundi and the general condition of the patient at any given time. Occasionally, the changes in the fundi progressed even after the patient was well enough to be out of bed, whereas in other instances definite improvement in the fundi was noted despite the fact that the patient was still gravely ill.

7. There were 27 deaths in this group of 100 unselected patients operated on for thrombophlebitis of the lateral sinus. All operated on were

Walsh, T. E., in discussion on Boies,[72] pp. 107-

Boies, L. R.: Acute Mastoiditis, 1931-1941, Tr. Otol., Rhin. & Laryng. Soc. **48**:97-107, 1942.

included despite the presence of abscess of the brain and meningitis on admission in a number of them. The mortality from the thrombophlebitis was much higher in old patients (over 30 years) than in children and young adults. Only by including all cases can the inherent mortality of thrombophlebitis of the lateral sinus ultimately be determined.

8. Nineteen patients were treated by operation combined with chemotherapy; 17 recovered and 2 died. The influence of chemotherapy in the treatment of bacteremia is great, and because of this one must beware of the tendency on the part of some to await the effect of chemotherapy alone in cases in which the lateral sinus is involved. Therefore, until substantial evidence to the contrary is advanced, one is justified in assuming that bacteremia due to thrombophlebitis of lateral sinus will or may persist despite che therapy and that surgical measures for the er cation of the phlebitic process are warranted.

9. The treatment generally employed in series of cases consists of obliteration of lateral sinus and ligation of the internal jug vein. I have purposefully avoided repeating well known and oft discussed reasons for against ligation of the jugular vein. In the analysis I feel that the significant fundame in the treatment is not so much the master the operative procedure or the omission of of it as it is an appreciation of the pathol nature of the suppurative focus.

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LOCAL USE OF SULFONAMIDE COMPOUNDS IN SURGICAL TREATMENT OF THE EAR

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The local use of sulfonamide drugs in the management of infected wounds is now well established in both civilian and military surgical practice. Perhaps the most conspicuous application has been in the treatment of compound fractures, since these are among the most frequent wounds of battle, the local application of sulfonamide compounds in such wounds is now common. Sulfonamide compounds have also been used extensively, and with equally satisfactory effects, in infected abdominal wounds. Livingston[1] apparently was the first to report on the use of sulfanilamide crystals in the cavity of the mastoid process after mastoidectomy. Since his report, the local use of sulfonamide drugs after mastoidectomy has become widespread, and numerous articles have appeared in the literature. These are essentially in agreement that the procedure when combined with good surgical technic has great value, although there are some minor differences of opinion regarding closure of the wound and the drug to prefer and certain discrepancies in the degree of enthusiasm for the procedure as expressed by different authors.

Before proceeding to discuss these reports on the use of sulfonamide compounds in the treatment of acute otitis media, I should like to call attention to the downward trend of disease of the mastoid process requiring mastoidectomy, which apparently can be attributed to the systemic use of chemotherapy in combating acute infections. So far as I know, this has not been mentioned in the literature. In my own practice I have noted a constant decrease of cases requiring mastoidectomy during the last few years, so I made a survey of the records in three Cleveland hospitals (table). Since in all of them the number of cases in which mastoidectomy was performed has decreased steadily since 1938, it would seem that there is indeed a decreased incidence of mastoiditis. The totals show that in 1937 there were 153 cases in which mastoidectomy was performed at these three hospitals; in 1938, 134; in 1939, 121; in 1940, 79; in 1941, 82; in 1942, 65, and in 1943, 35. Thus the number in 1943 was only a little more than 20 per cent of that in 1937. That cases in which mastoiditis required surgical intervention have been reduced by four-fifths within six years seems another significant achievement to credit to the sulfonamide drugs.

Number of Cases in Which Mastoidectomy Was Performed in Three Hospitals in the Period 1937 to 1943 Inclusive

	Year	Total Number of Cases with Mastoidectomy	Cases in Which Given Type of Mastoidectomy Was Performed	
			Radical	Simple
St. Vincent Charity Hospital, Cleveland	1937	57	7	50
	1938	31	4	27
	1939	45	3	42
	1940	24	5	19
	1941	33	11	22
	1942	30	13	17
	1943	15	5	10
City Hospital, Cleveland	1937	70	..	..
	1938	73	..	..
	1939	51	..	..
	1940	28	5	23
	1941	35	10	25
	1942	11	4	7
	1943	8	2	6
Lakewood Hospital, Lakewood, Ohio	1937	26	1	25
	1938	30	2	28
	1939	25	..	25
	1940	27	3	24
	1941	14	..	14
	1942	24	6	18
	1943	12	2	10
Totals	1937	153		
	1938	134		
	1939	121		
	1940	79		
	1941	82		
	1942	65		
	1943	35		

OTITIS MEDIA

Acute Form.—Considerable difference of opinion has been recorded regarding the efficacy of the local treatment of acute otitis media. Fenton[2] expressed the belief that sulfathiazole powder is not suitable for insufflation into the canal in cases of acute infection, although he recommends it in certain cases of chronic infection. Connell and Trowbridge,[3] on the other hand, report good re-

1. Livingston, G. S.: Local Sulfonamide Therapy in Acute Mastoiditis, J. A. M. A. **117**:1081-1085 (Sept. 25) 1941.

2. Fenton, R. A.: Local Use of Sulfathiazole in Otorhinolaryngology, Arch. Otolaryng. **37**:491-495 (April) 1943.

3. Connell, E. S., and Trowbridge, B. C.: Local Use of Sulfanilamide and Its Derivatives in the Ear, Nose and Throat, Arch. Otolaryng. **35**:740-744 (May) 1942.

sults and no untoward reactions following the local use of sulfanilamide and sulfathiazole powder for purulent acute infections.

My own experience has been that sulfanilamide powder lightly insufflated into the auditory canal after myringotomy, shortens the period of drainage and helps to prevent local irritation of the canal. A 5 per cent sulfathiazole ointment applied externally prevents local irritation from drainage. Sulfanilamide powder does not cake or block the canal as sulfathiazole powder may. The latter sometimes forms a hard crust, causing obstruction, and is sometimes difficult to remove. I have observed no untoward effects from the local use of sulfanilamide powder in the therapy of acute otitis media, but care must be taken in regard to the amount of powder used.

Chronic furunculosis of the auditory canal responds rapidly to the local use of a 5 or 10 per cent sulfathiazole ointment. Some ointments seem to have a more soluble base than others, and this probably facilitates action of the drug.

Chronic Form with Mastoiditis.—Silcox and Schenck [4] reported 14 cases in which chronic otitis media was treated with a suspension of microcrystals of sulfathiazole with satisfactory results. Bryant [5] reported similar good results with sulfanilamide powder. In 11 cases in which local treatment with alcohol and boric acid had been unsuccessful (the discharge had not subsided completely in any of these patients at any time in four years), the cavity of the middle ear was cleansed with cotton-tipped applicators or by gentle irrigation with 70 per cent alcohol and dried before sulfanilamide powder was insufflated. Only 1 among the 11 ears failed to respond; in the others one to six treatments were required to obtain cessation of the discharge.

It has been routine practice with me during the last two and a half years to use sulfanilamide powder locally in ears with chronic otitis media. I have found that the type and the location of the perforation of the tympanic membrane influence the results. In the ears most amenable to treatment there usually is a large, centrally situated perforation with a considerable tendency toward adhesions in the middle ear and with a mucopurulent discharge. Frequently drainage will cease after one or two treatments if the middle ear is gently and thoroughly cleansed of all mucopurulent material and sulfanilamide powder insufflated. Ears in which there is a marginal or an attic perforation, usually small, with a thin purulent discharge and evidence of cholatomatous or other debris are much more resistant to treatment. Of course, this is indicative involvement of the mastoid process, and quently it necessitates surgical intervention. many cases, however, the condition can be trolled in that no discharge will be present months at a time. Many patients prefer to periodic treatment rather than to be subje to operation and subsequent loss of hearing this type of case, it is common to have good ing. When granulation tissue is present, must be removed as thoroughly as possible all bleeding controlled before sulfanilamide der is used.

Granulation tissue in the middle ear us reappears quickly after its removal, but o somewhat surprised to note how this tendenc obviated after a few applications of sulfanila Furstenberg's [6] statement that with concentra prolonged application of sulfanilamide the evidenced a deleterious effect on the proces repair may help to explain the effect on gr lation tissue in the middle ear. Thus the is useful in combating an overzealous attemp the part of nature to fight infection. This exu ant granulation tissue is an annoying and present factor in cases of mastoidectomy. S thiazole seems more effective than sulfanila in controlling recurring granulation tissue though, as already noted, it displays more dency to cake. If granulation tissue is contro with sulfathiazole, subsequent treatment ca carried on with sulfanilamide until a dry ea obtained.

Use of a cannula in the attic for remov debris is frequently advisable, and saline solu is preferred for this. However, in most cas prefer the dry treatment.

MASTOIDECTOMY

Simple Type.—The local use of sulfona compounds has greatly shortened the postop tive course after simple mastoidectomy. authors are agreed on this, but they exhibit di ence of opinion in the choice of sulfonamide c pounds and in the manner of closing the wo The earlier reports seem to favor use of s thiazole powder and partial closure, leavi drain or a wick in the lower end of the wo In this connection Livingston's first report interesting. In his first group of cases, s amounts of sulfanilamide were used, an rubber drain was inserted, and the results ap

4. Silcox, L. E., and Schenck, H. P.: Use in Otolaryngology of Microcrystals of Drugs of the Sulfanilamide Group, Arch. Otolaryng. **36**:171-186 (Aug.) 1942.

5. Bryant, F. L.: Local Use of Sulfanilamide in Otogenic Infections, Arch. Otolaryng. **35**:281-285 (Feb.) 1942.

6. Furstenberg, A. C.: Local Sulfonamide The in Otolaryngology, Laryngoscope **53**:93-100 (Feb.)

were no better than if no sulfanilamide been used. In a second group (13 cases), cavity was filled with sulfanilamide or sulfazole crystals and the wound sutured tightly, out drainage, and in these the healing time decreased and postoperative hospitalization tened considerably.

enton [2] said that he had found it possible in st every case to make primary closure of the toidectomy wound by careful hemostasis and ing in of sulfathiazole powder to cover the s of the operative cavity. He expressed the ion that it is undesirable to fill the cavity, ough this is recommended by some authors, use excessive powder may act as a foreign in a large granulating wound. Gauze packs ubber drains are not used.

urstenberg [6] stated that sulfanilamide when locally in septic wounds tends to shorten the od of convalescence, prevent troublesome reactions and allay discomfort. He stressed, ever, and in this I heartily agree, that local of sulfanilamide is no substitute for a surgical edure adequately performed. As he said:

> . . Confidence in local chemotherapy is justified when it is employed as an adjunct to an operation h is performed with credit to the surgeon and safety e patient.

or this reason, I believe that it is justifiable lose a simple mastoidectomy wound comly after local use of sulfanilamide. The ungated action of the drug and the purpose for h it is used are frustrated if a drain is used. ood dictum is to watch the patient carefully leave the dressing alone. If there is no sudunexplained rise in temperature, the dressing ld be left four to six days without changing. in I quote from Furstenberg:

> . . While we must not permit infection to become ed under pressure within a temporal bone because e vital adjacent cerebral coverings, nevertheless, convinced that if mastoid operations were always done, the wounds left partly open and the head osed in a plaster cast, to keep the doctor out of the healing would be more satisfactory and convance more rapid in the average patient!

tamination in such wounds is always introed from the outside.

adical Type.—In the treatment of the patient r radical mastoidectomy the local use of onamide compounds has greatly shortened convalescence of the patient and facilitated task of the surgeon. It has been my custom make the usual T-shaped plastic flap in the terior part of the auditory canal and then to in a dry field and pack the cavity through a ber tube with gauze, after filling it with a sulamide drug, preferably sulfanilamide powder. This pack is left in place for two days. Then it is removed, the rubber tube being left in position, and the cavity is cleansed daily with dry cotton, followed by light insufflation of sulfanilamide powder. This minimizes formation of granulation tissue and greatly shortens the period of epithelization.

COMMENT

Several authors have reported that they have administered sulfonamide compounds by mouth along with local application of these drugs in the mastoidectomy wound, but this would appear to be superfluous unless there is some definite indication that infection is not being controlled. In approximately 75 cases in which I have used sulfanilamide or sulfathiazole in the mastoidectomy wound I have found no need for oral administration and have seen no recurrence of local infection. Shaver [7] stated that although he had used sulfathiazole in moderate doses by mouth along with local application after mastoidectomy this would appear to be unnecessary.

It has been stated by some authorities that the effect of a powdered sulfonamide drug in a wound is entirely local and that there is no evidence of its presence in the blood stream when it is not being administered otherwise. However, Livingston [8] reported that a blood level of 4.7 mg. per hundred cubic centimeters of blood was reached in twenty-four hours after 4 Gm. of sulfanilamide was placed in a postoperative cavity of the mastoid process. The second day the content had dropped to 0.95 mg. and by the third day it had disappeared.

The drug used by Shaver,[7] Fenton,[2] Silcox and Schenck [4] and Guerry and Putney [9] was sulfathiazole. Fenton expressed the belief that it was preferable because of its relatively slow solubility in tissue fluids. Silcox and Schenck also expressed a preference for it because it is less irritating and in dissolving more slowly is capable of more prolonged effect. They stated that when immediate action of the drug is desired, a mixture of microcrystals of sulfathiazole and sulfanilamide results in immediate action of the sulfanilamide. Livingston [1] used sulfanilamide. Herzig [10]

7. Shaver, F. W.: Use of Sulfathiazole with Primary Mastoid Wound Closure, Canad. M. A. J. **47**: 7-11 (July) 1942.

8. Livingston, G. S.: Clinical Experience with Sulfonamides, Ann. Otol., Rhin. & Laryng. **52**:171-179 (March) 1943.

9. Guerry, DuP., III, and Putney, F. J.: Local Use of Sulfathiazole in Management of Simple Mastoidectomy Wounds, Arch. Otolaryng. **35**:399-407 (March) 1942.

10. Herzig, A. J.: Preliminary Report of Complete Closure of Wound by Primary Suture (Value of Powdered Sulfanilamide and Sulfathiazole), Laryngoscope **53**:431-432 (June) 1943.

recommended equal parts of sulfanilamide and sulfathiazole with complete filling of the wound. Connell and Trowbridge [3] have used both sulfathiazole and sulfanilamide, and Bryant [5] has found these two drugs equally effective. Furstenberg [6] stated that he has used both, the choice depending on the infecting organism. Tucker and Flake [11] reported a controlled series of 41 cases in which sulfadiazine was used. One group of patients received sulfadiazine locally with complete closure of the mastoidectomy wound, and in another group sulfadiazine was administered by mouth and the wound was likewise closed without draining. The results were practically the same in both groups, although in the second group the wound broke down in 1 case. Kolmer [12] has commented on the use of sulfanilamide, sulfathiazole and sulfadiazine.

I have used both sulfathiazole and sulfanilamide with equally satisfactory results, but in view of some untoward effects reported by others with sulfathiazole, I now use sulfanilamide routinely. As already mentioned, sulfathiazole has a greater tendency to cake when used in the middle ear, and hence sulfanilamide is preferable. Since sulfathiazole seems to exert a more inhibiting effect on granulation tissue, it is preferable in combating this.

All authors are agreed that sulfonamide compounds in the form of powder should be fine or moderately fine, since larger granules are not readily dissolved and may coalesce and act as a foreign body. Connell and Trowbridge [3] recommended the use of powder which has been sifted through gauze 40 by 100 mesh per square inch.

There also is agreement that sterilization of the drug is unnecessary.

SUMMARY

In my experience the local use of a powdered sulfonamide compound and complete closure of the wound after mastoidectomy represent a definite step forward in the surgical treatment of mastoiditis. Local infection and drainage are reduced to a minimum, and postoperative convalescence is greatly shortened. There is some difference of opinion about the best drug to use, but, all things considered, sulfanilamide is probably preferable among those now available. Local insufflation of a powdered sulfonamide compound also is efficacious in many cases of acute and chronic otitis media.

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11. Tucker, C. A., and Flake, C. G.: Use of Sulfadiazine in Management of Simple Wounds, New England J. Med. **227**:1021-1024 (Dec. 3) 1942.

12. Kolmer, J. A.: Chemotherapy, with Special Reference to Sulfonamide Compounds, Tr. Am. Acad. Ophth. **47**:36-45 (Sept.-Oct.) 1942.

RATIONAL THERAPY IN ACUTE OTITIS MEDIA

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e literature is diffusely infiltrated with sug-
ns concerning the therapy of acute otitis
a. The subject is a time-honored one and
ably so. Treatment of the condition has
ally changed during the past few years,
the advent of the various sulfonamide com-
ds. The monumental work of Domagk,
demonstrated that prontosil [1] exerted a
ive action on streptococcic infections in
cannot be minimized.[2]

petzky [3] said:

> The literature is replete with clinical material adds little to the sum of knowledge, and one is d even to find the raison d'être for some of the eports, since they settle no questions and too often eiterate accepted facts and customary procedures.

most phenomenal results in all cases of acute ven subacute otitis media have been obtained adequate and carefully supervised use of namide compounds (see the accompanying).

Analysis of Cases

r of patients treated		824
sms cultured		10
Streptococcus, staphylococcus, pneumococcus	92%	
Other organisms	8%	
r of patients operated on		2
r of deaths (fulminating type)		1
tage of patients treated by operation		0.0024
tage of patients treated who died		0.0012
tage of patients with loss of hearing		2
r of cases in which roentgen studies were made		52
tage of cases in which roentgen examination ed definite signs of pathologic change in mastoid process		40
tage of cases of purulent otitis media in series		30

is obvious that the patient presents himself reatment with a history of earache and acute tion of the upper respiratory tract or of the nasopharynx and that the ear is in the throes of an acute catarrhal condition or is suppurating from either a spontaneous rupture or an incision of the tympanic membrane. There is an infectious process in the middle ear, which includes the eustachian tube.

The facts concerning the variations in the anatomic findings in infants and adults are well known. The method by which the infection has localized in the middle ear is debatable, but the fact that the patient has an acutely inflamed area which may become a grave problem is far more significant. The patient is toxic, the ear is painful, it may or may not be discharging, and serious subsequent complications may occur. Among the latter may be mastoiditis, thrombosis of the lateral sinus, thrombosis of the cavernous sinus, meningitis, petrositis, labyrinthitis and partial loss of hearing.

When one is rationalizing concerning therapy, certain facts should be at hand: (1) There should be a careful anamnesis; (2) the severity of the infection, whether fulminating or not, should be determined; (3) the results of a bacteriologic examination should be known; (4) the effect of early instituted chemotherapy should be noted; (5) there should be institution of therapy with reference to the nose, the throat, the sinuses and the eustachian tube, (6) the termination of discharge, if it occurs, should be considered, and (7) the restoration and the maintenance of hearing must be established.

A careful history is most advisable. Onset of earache, and accompanying head cold, and an ear already discharging are pertinent factors. Have there been recurrences of this same trouble? How often and for how long have they occurred; i. e. for how long has the ear drained previously?

The severity of infection must be considered. I have seen a few patients in whom the ear has ruptured within two hours after the onset of an earache, and mastoiditis with complicating thrombosis of the cavernous sinus has followed within sixty hours, and subsequently death has occurred. Three of these patients were seen a decade ago, prior to the use of the sulfonamide compounds, 1 since (table). In these cases of fulminating disease even chemotherapy may not

resented as a candidate's thesis to the American ngological, Rhinological and Otological Society in

This was the original prontosil (the hydrochloride sulfamido-2′,4′-diaminoazobenzene).

A most complete review of the literature published g the early years of the use of sulfonamide com-ds in therapy is that of H. P. Schenck: "Use of nilamide in Otolaryngology" (Arch. Otolaryng. **28:** [Nov.] 1938). This article with 227 references is worth while reading.

Kopetzky, S. J.: Purulent Otitis Media, Sinus mbosis and Suppuration of Petrous Pyramid, Arch. ryng. **28:**626 (Oct.) 1938.

retard effectually the alarming rapidity with which the events occur.

The bacteriologic determination of the type of infection is important, but therapy must be instituted before this knowledge is obtained and then altered as necessary to conform with the best known methods of combating the specific organism. The organisms most frequently causing otitis media are group A hemolytic streptococci, pneumococci and staphylococci. Neter, Neuburger and Short [4] stated that complicating mastoiditis is less apt to occur with staphylococcic infection. In my series of cases streptococci predominated, pneumococci were second, staphylococci third, and various other organisms were found. Staphylococci may or may not be pathogenic, and the result of the plasma coagulation test (Fisk [5]; Cruickshank [6]) is an excellent criterion to follow. In cases of nonsuppurative otitis media bacteriologic examinations of the nasopharynx were made. It must be mentioned that contaminating organisms may overshadow the true pathogen. Bowers [7] has shown this to be true.

The immediate need is to combat the infection, and I have followed this procedure: (*a*) An intramuscular injection of 1 or 2 cc. of 5 per cent azosulfamide is given immediately. (*b*) Sulfathiazole or sulfadiazine (in an earlier period sulfanilamide) is given in adequate doses to maintain a high blood level with particular concentration during the sleeping hours. (*c*) Atropine sulfate is administered by mouth or hypodermically to alleviate the congestion of the eustachian tube and afford drainage through the tube if possible. (*d*) A preparation of codeine sulfate and papaverine hydrochloride is given if the catarrhal stage is in its incipiency, with a highly reddened drum membrane or one beginning to bulge. (*e*) More recently, large doses of ascorbic acid given early have seemed to be of value. (The dosage should be 1 Gm. administered four times a day, taken orally or administered intravenously.) During the last month I have used sulfamerazine (2-sulfanilamido-4-methylpyrimidine) with brilliant results. The preparation has proved so far to be less toxic, and the results have been glowingly gratifying.

The treatment of the nasopharynx mus carefully considered. If the eustachian tub open, it affords more adequate drainage fo rest of the middle ear. I have not been too thusiastic about the topical application of various sodium sulfathiazole sesquihydrate p arations but have used them extensi Powdered sulfonamide compounds used h in the ear and nose may prove beneficial. nell and Trowbridge [8] covered this in article. The activated sulfanilamide is pro beneficial. Gentle aeration of the eustac tube by the Valsalva method is to be re mended. Physiotherapeutic measures offer fort and perhaps are beneficial.

Treatment with sulfonamide drugs is tinued until there has been a complete subsid of the acute symptoms and until the ear ceased to discharge. This usually occurs w three to seven days, but occasional cases in w the infection is refractive offer more con Blood counts are absolutely necessary if chemotherapy is prolonged, urinalyses are a uisite, and blood concentration tests are n in every case in which the infection has not mediately responded to the outlined measu Combined derivatives of the sulfonamide pounds have proved satisfactory in many c If the disease processes are not controlled one group of azobenzenes, a change to an is certainly permissible. Some of these meas may not meet with the approval of many ogists, but they have proved to be succe in my hands.

The literature abounds in remarks concer the so-called masking of symptoms. Cert I am aware of this, but I challenge the state with reference to its seriousness. In the e lent article by Harris [9] Shuster stated: "T are certain cases in which one must not let servative measures create over-enthusiasm ing dangers to be overlooked." Of course masking of symptoms is gravely important, in my series of over 800 cases I have coped it liberally, but I take great pride in being to analyze the seriousness of each case caref its progress, the masking problem, the degr treatment with sulfonamide drugs necessar order to have the patient well. Nor shall part and parcel to the desire to display my s cal prowess in order to keep in touch with operative field in the mastoid area.

The relation between doctor and pa should be such that the doctor, by what

4. Neter, E.; Neuburger, F., and Short, M. L.: Otitis Media and Mastoiditis in Children, Arch. Otolaryng. **35**:631 (April) 1942.

5. Fisk, A.: The Technique of the Coagulase Test for Staphylococci, Brit. J. Exper. Path. **21**:311 (Oct.) 1940.

6. Cruickshank, R.: Staphylocoagulase, J. Path. & Bact. **45**:295 (July) 1937.

7. Bowers, W. C.: Observations on Seven Hundred and Ninety-Three Cases of Acute Purulent Otitis Media, with Chemotherapy in Three Hundred and Ninety-Six Cases, J. A. M. A. **115**:178 (July 20) 1940.

8. Connell, E. S., and Trowbridge, B. C.: Use of Sulfanilamide and Its Derivatives in the Nose and Throat, Arch. Otolaryng. **35**:740 (May)

9. Harris, R.: A Treatment of Chronic Pur Otitis Media, Arch. Otolaryng. **26**:522 (Nov.) 19

s necessary within his armamentarium, can n the best results. It is always a moment nportance when the doctor can say: "You vell. It will not be necessary for me to see again, but if you should be sick again, please me." The "whatever means" mentioned be the most scientific approach to the prob- In my estimation, based on six years of ul and guarded study, the results have been usive.

SUMMARY AND CONCLUSIONS

refully planned chemotherapy augmented by r nasopharyngeal therapy in cases of acute rrhal and purulent otitis media minimizes possibility of complications arising in these conditions. The severity of the infection, the history of the case and the results of the bacteriologic examination must be considered. Termination of the discharge, if present, and restoration of hearing are essentially problems of the otologist, and these problems are present in every case of acute infection of the middle ear. Masking of symptoms by sulfonamide therapy must be diligently studied. If adequate and well supervised chemotherapy has been given, operative intervention is rarely needed except in cases of fulminating disease. These observations and conclusions are based on an analysis of over 800 cases.

Dean Studio Building.

IMPORTANCE OF PATHOLOGIC CONDITIONS OF THE NASOPHARYNX TO THE OTOLARYNGOLOGIST

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A complete and thorough examination of the nasopharynx has been repeatedly emphasized in recent years by Carmody,[1] Hill,[2] Coates [3] and others. Otolaryngologists who have heeded these stimulating papers have had the satisfaction of solving perplexing diagnostic problems. However, there are still many who are relatively neglecting this important area and are thereby not only jeopardizing their professional reputation but failing the referring physician and not keeping faith with the patient who confidently places himself in the hands of a recognized specialist. The purpose of this paper is not to offer anything new but to arouse further interest in the nasopharynx by presenting proved methods of examination and by stressing the importance of the pathologic conditions that may be present.

The nasopharyngeal space located posterior to the nasal choanae and the soft palate is not visible to the casual examiner, but it can be thoroughly inspected either through the nose or through the mouth with special instruments if the difficulties of introducing these instruments are overcome and skill is attained in recognizing the varying pictures presented by the different methods of examination. Anatomically, the normal nasopharynx presents considerable variation as it is viewed with reflected light, with the postnasal mirror and through the lens of the nasopharyngoscope. Therefore frequent use of these methods is necessary to achieve ability in the recognition and evaluation of any pathologic change that may be present.

A considerable number of special instruments have been devised to overcome the difficulty of inspecting this comparatively inaccessible area, viz.: the small caliber Holmes nasopharyngoscope, the Beck nasopharyngoscope, the Yankauer pharyngeal speculum, the Hasslinger palate retractor, the White palate retractor and the Love palate retractor. This array of instruments to create the impression that one is abo launch on a formidable, complicated and consuming procedure. On the contrary phase of the routine examination of the no the throat of the average patient should re little additional time once a plan of app has been adopted and repeatedly carried The method and the instruments employed vary with the individual physician. My p first to inspect through the anterior part of naris with reflected light, then to use the H nasopharyngoscope and finally, if this exa tion is not satisfactory or if there are symp and signs of nasopharyngeal disease, to e the soft palate and retract it sufficient visualize the nasopharyngeal area adequate direct inspection or for inspection with the nasal mirror.

An inspection made through the anterior of the naris by reflected light will yield siderable information about the nasal ch and the nasopharynx if it is carefully done the nasal mucosa has been thoroughly shru and moderately anesthetized. This would unnecessary statement if many otolaryngol did not see patients with nasal obstruction have been treated and operated on without when the cause of the obstruction could been identified by reflected light alone. depths of the nares are adequately illumi and the different structures identified an vestigated with a cotton-tipped applicator, h plastic posterior ends of turbinates, ch polyps and other growths will not be overlo Additional information may be obtained by the gaze on the posterior wall of the nasopha at the level of the floor of the nose and requ the patient to swallow. This act will brin posterior surface of the soft palate into v large adenoids or other growths do not elevation of the palate.

The nasopharyngoscope is next emp This is probably the most useful instrument able for exploring the deep recesses of the and the nasopharynx, and its use deser place in every routine examination of the

1. Carmody, T. E.: Epipharynx—Almost Unknown in Otolaryngology, Tr. Am. Acad. Ophth. **44**:255-264, 1939.

2. Hill, F. T.: Diagnostic Pitfalls of the Nasopharynx, Tr. Sect. Laryng., Otol. & Rhin., A. M. A., 1940, pp. 62-70.

3. Coates, G. M.: The Nasopharynx, Arch. Pediat. **60**:10-18 (Jan.) 1943.

the throat. Any apparent disadvantages will largely overcome by frequent use and by remembering a few details in the technic. After cus and pus have been removed from the opharynx and the floor of the nose, the instrument is gently and carefully passed through the es with the aid of reflected light. If an instrument with a cord attachment is used rather than clumsy battery handle, there is practically no comfort to the procedure. The patient is then tructed to close the mouth and breathe regularly through the nose. This will relax the soft ate and permit a rapid and thorough inspection of the nasopharynx. This method is especially valuable in tracing streams of pus to their rce, detecting small new growths and inspecting the areas about the eustachian tubes.

A patient was recently seen who claimed that had a fishbone behind his soft palate. By ns of the nasopharyngoscope the bone was ted just above the posterior lip of the right tachian tube. With the instrument in the left is, it was possible to grasp the foreign body ough the right naris to remove it.

A satisfactory examination behind the soft ate by direct inspection or with the postnasal ror is seldom easy and many times is extremely difficult. When the soft palate is suspended forward in a comparatively insensitive throat, problem is presented, but when the patient is ooperative and in addition possesses a sensitive gagging throat with the soft palate in contact with the posterior pharyngeal wall, the procedure requires patience and perseverance even r the area has been anesthetized.

A satisfactory method of applying an anesthetic ically is to use an applicator with its distal 3 firmly wrapped with cotton and bent to conform roughly to the curvature of the soft palate en it is introduced through the nose. Such an licator carrying cocaine or larocaine hydroride is passed through each naris and permitted to remain in place for a few minutes.

In some cases it is necessary to inject into the tor innervation of the levator veli palatini scles procaine hydrochloride before the palate be retracted sufficiently to expose the nasoarynx. This may be done by introducing a needle into the external third of one half of soft palate at the level where dimpling or entation occurs on contraction. The needle is advanced toward the lateral surface of the tracted levator veli palatini and at a depth of 2 cm., 1 cc. of 1 per cent solution of procaine hydrochloride is injected. After an injection has been made on each side of the throat, the stic palate becomes relaxed. This procedure suggested by the temporary paralysis of the palate often observed after injecting the anesthetic into tissues of the throat for tonsillectomy.

A routine review of the literature in conjunction with the preparation of this paper revealed that Gyergyay,[4] a Swedish physician, had reported essentially the same technic in 1939.

After the throat has been adequately anesthetized, the posterior and lateral walls may be directly inspected with the aid of the Yankauer pharyngeal speculum or the Love palate retractor. The entire nasopharynx may be visualized by means of the postnasal mirror or the Beck nasopharyngoscope after the self-retaining Hasslinger palate retractor is in position.

Direct inspection is particularly valuable in diagnosing and treating retention abscesses of residual adenoids as well as cysts due to persistence of an embryonal bursa. Yankauer,[5] Kully [6] and others have emphasized the frequent occurrence of these conditions. I recently saw a primary syphilitic lesion in this location.

The lymphoid tissue of the nasopharynx must be evaluated. The large obstructive masses are treated by surgical removal, but there is considerable difference of opinion as to the most effective method of eliminating the generalized and patchy lymphoid hypertrophy that is often responsible for recurrent attacks of nasopharyngitis and impairment of hearing due to tubotympanic catarrh. Guggenheim [7] advocated surgical removal, Crowe [8] recommended use of a radon nasal applicator and others have expressed the belief that cross-firing roentgen ray treatment is most effective.

High retropharyngeal abscesses and abscesses of the petrous pyramid from mastoiditis may be found in this area.

The roentgenogram will often give important information when a neoplasm or an abscess is present. Digital examination is also of value in determining the consistency and the extent of a tumor or of an inflammatory swelling.

Any new growth in the nasopharynx should be subjected to biopsy if there is a question concerning its character. The lymphoid mass, the choanal polyp, the fibroma and cancer must be differentiated for prognosis and treatment.

4. Gyergyay, A.: Sensitivity, Anesthetization and Innervation of the Nasopharynx, Acta oto-laryng. **27**: 519-527, 1939.

5. Yankauer, S.: Nasopharyngeal Abscess: Report of 155 Cases, Tr. Am. Acad. Ophth. **34**:364-375, 1929.

6. Kully, B. M.: Cysts and Retention Abscesses of Nasopharynx, Tr. Am. Laryng., Rhin. & Otol. Soc. **40**: 185-199, 1934.

7. Guggenheim, L.: Therapy of Deafness, Laryngoscope **53**:503-518 (Aug.) 1943.

8. Crowe, S. J.: Nasopharynx, Tr. Am. Laryng. A. **62**:145-157, 1940.

Juvenile basal fibroma of the nasopharynx is rare. It usually appears as a hard, rounded, slightly nodular, deep red, purplish or grayish tumor with a broad firm attachment high on the posterior wall or the vault of the nasopharynx. In Figi's [9] large series of 63 cases the average age of the patients was 16 years and male outnumbered female patients by almost 12 to 1.

A youth aged 16 was referred because of frequent epistaxis. Examination revealed the posterior part of the left naris to be completely obstructed by a hard new growth. Biopsy confirmed the diagnosis of fibroma. After the growth was destroyed by radon seeds, the area of attachment was located in the vault of the nasopharyx, involving the lateral portion of the superior border of the left choana.

Of all the lesions seen in this region the malignant growth is probably the most important from a diagnostic standpoint. It may invade the bone, affect the cranial nerves and metastasize to the glands of the neck while the primary lesion in the nasopharynx is still quite small.

New,[10] in a study of 79 cases of cancer of the nasopharynx in 1922, found that symptoms referable to the nose and the pharynx were presented only in 38. He emphasized that patients with pain in the ear and the face, enlargement glands in the neck, tinnitus, deafness or do vision should have a careful examination of nasopharynx.

A woman aged 44 years was referred in 1942 for treatment of sinusitis and impair of hearing in the right ear. Examination reve the posterior part of the right naris comple blocked by a mass resembling lymphoid ti Although a biopsy was reported as sho fibrosis of lymphoid tissue, the patient wa ferred for roentgen therapy. Within five w the growth had melted away to a small nodu Rosenmüller's fossa. A biopsy specimen of remnant of the tumor was reported as lym sarcoma. There has been no recurrence in nasopharynx, but enlargement of glands has curred on both sides of the neck and has sponded to roentgen treatment. In March of year a large nodular shadow was seen roentg graphically in the upper lobe of the left l which disappeared after high voltage roen therapy.

CONCLUSIONS

The nasopharynx should not be neglecte routine examinations of the nose and the th It can be adequately examined by the met presented in this article. Many important pa logic conditions may be encountered in nasopharynx.

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9. Figi, F. A.: Fibromas of the Nasopharynx, Tr. Sect. Laryng., Otol. & Rhin., A. M. A., 1940, pp. 116-140.

10. New, G. B.: Syndrome of Malignant Tumors of the Nasopharynx, J. A. M. A. **79**:10-14 (July 1) 1922.

DIABETIC GANGRENE INVOLVING THE SINUSES

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iabetic gangrene of the nose is rare enough e reported as a medical curiosity. A search e literature showed only 15 cases of diabetes ving the head. Eight cases of diabetes in- ing the nose or the sinuses were recorded; e tongue; 2, the eyes; 6, chiefly the face, and n area about the ear. Three new cases are rted in this article.

Trautmann [1] reported in 1910 the case of a of 52 with diabetes in whom necrosis of septum developed and who "sneezed out a e of cartilage the size of a 5 pfennig piece."

owers [2] in 1924 reported a remarkable series cases in which the patients were all children r 11 years of age. The first 2 patients were before insulin was discovered, and both . The third recovered with insulin. The patient was aged 4½. There was gangrene e septum and of both left turbinates, also a of tissue of the left side of the roof of the th. The second patient was 10 years old, had gangrene of the left lower eyelid and k. The third patient was also aged 10. She almost complete loss of the septum and much ling of the eyelids but with insulin she vered.

onnell [3] reported the case of a man of 35 in m infection of the ethmoid sinuses and of antrums developed as a complication of re diabetes. He had a slough of the septum a perforation of the hard palate, leaving an ning from the mouth into the right antrum. recovered with insulin.

Morris [4] had a patient in whom the septum and a turbinate sloughed out. The patient was a woman of 58. She recovered with insulin.

Ardeshir,[5] of India, reported the case of a child of 8 with gangrene and loss of the right ala nasi. The patient recovered with insulin.

In reporting a fatal case of gangrene involving the left orbit, the cheek and most of the hard palate, Bulger [6] stated "that occlusion of a single large artery could not account for the distribution of the necrosis." The patient, a woman of 21, died in spite of insulin. The onset followed a stye of the lower left eyelid. He also told of the case of a physician, aged 65, in whom the right half of the tongue was sloughed out following an infection.

Brooks [7] reported briefly the case of a man with gangrene of both sides of the face. The onset resembled erysipelas. The infection ended with death on the seventh day.

Brier's [8] case was that of a farmer of 24 in whom a red tender area developed just in front of the left ear. Coma followed two days later. The whole right ear became involved, but only the upper third sloughed off. The gangrene in front of the ear must have extended deeply since the fifth and seventh nerves became paralyzed.

Wood [9] presented the case of a woman of 60 who bruised her nose in a fall. Infection set in; coma followed. Three months later the entire

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resented at the meeting of the American Laryngo- l, Rhinological and Otolaryngological Society in York on June 9, 1944.

rom the Department of Otolaryngology, University outhern California School of Medicine, service of cKenzie Brown, M.D.

Trautmann, G.: Nasendestruktion infolge Erk- ungen des Septum mit besonderer Berücksichtigung Hämatome und Abscesse, Arch. f. Laryng. u. Rhin. 60, 1910.

Bowers, C. H.: Gangrene in the Nose Complicat- Diabetes, J. A. M. A. **82**:1325 (April 26) 1924.

Connell, E. S.: Diabetic Gangrene of the Nose, J. souri M. A. **21**:277 (Aug.) 1924.

4. Morris, A. G.: Gangrene of the Middle Turbinate, Sequestration of the Nasal Septum, Mucocele of Frontal Sinuses, in a Case of Diabetes, New York State J. Med. **24**:987 (Dec.) 1924.

5. Ardeshir, K.: Gangrene of the Nose Due to Diabetes Mellitus, Lancet **1**:1256 (June 26) 1926.

6. Bulger, H. A.: Gangrene of the Orbit and Nares in Diabetes Mellitus, J. Missouri M. A. **26**:304 (June) 1929.

7. Brooks, G. P.: Diabetic Gangrene of the Face, Brit. M. J. **2**:539 (Sept. 21) 1929.

8. Brier, A. J.: Diabetic Gangrene of the Face and Ear Complicated by Fifth and Seventh Nerve Involvement, J. A. M. A. **103**:170 (Dec. 1) 1934.

9. Wood, T. B.: Spontaneous Amputation of the Nose Due to Diabetic Gangrene, Ann. Otol., Rhin. & Laryng. **46**:1112 (Dec.) 1937.

nose, including the septum, had become gangrenous and was removed. This patient was the only one in whose case there was a positive Wassermann test.

Millet [10] in 1939 saw 2 adults with fatal gangrene of the face. In both the organism was Staphylococcus aureus. He stressed the resemblance to erysipelas in the early stages and suggested that a culture should help in the differential diagnosis, as the hemolytic streptococcus is always found in erysipelas.

Goldberg [11] gave a careful review of the literature in 1940 and reported a case of gangrene of the septum, ethmoid cells and turbinates. A fistula developed over the right side of the bridge of the nose. The patient recovered.

PATHOLOGY

The exciting cause of diabetic gangrene about the head seems to be infection. In almost every case the diabetes is described as uncontrolled, and in most cases the patient was near diabetic coma at the beginning of the infection. In a few cases trauma played a part.

Warren [12] wrote in his textbook:

> Sepsis is the greatest foe of the poorly treated diabetic. . . . Just as arterio-sclerosis is the bugbear of the diabetic who is doing well, so is infection the fear of the diabetic doing poorly. The more severe his diabetes, the more susceptible he is to infection, and once infected, his diabetes becomes far more severe. . . . The patient with pre-established diabetes requires two to four times as much insulin when infection intervenes.

Warren made the statement, and I have checked it with other pathologists, that he had never seen an autopsy on a person with diabetes of more than five years' duration that did not demonstrate severe arteriosclerosis, regardless of age. At first I was of the opinion that diabetic gangrene of the head came chiefly as a result of infectious thrombosis of a terminal artery, an artery already almost closed by diabetic arteriosclerosis in which thrombosis was precipitated by infection. I am now not sure that this is so. If these were the only important factors, I think one would find diabetic gangrene more frequently in the nose and the throat since one encounters so many infections in these regions. Bulger [6] stated:

> . . . It may possibly have been related to an extre edema developing in a relatively closed space similar gangrene which is seen after subcutaneous injection calcium chloride or strong glucose solutions. . . Tissues devitalized by the relative absence of carb hydrate in cell metabolism may be thought of approaching death and conceivably less able to toler the local high concentration of toxins.

Since in all cases reported and in the 3 cas observed by me the patient was in or near com one must assume that a high degree of acidos and local infection are the chief factors and th infectious thrombosis of a terminal artery is third factor. The fact that in 3 previously re ported cases and in all of my 3 cases the ha palate was affected is evidence that thrombosis one or more terminal arteries occurs.

Multiple gangrenous areas of the skin of th back and of the posterior regions of the low parts of the legs were observed by Riven [13] in patient entering the hospital in diabetic com He quoted Brewer and Meleney [14] as being ab to produce gangrenous ulcers in animals by in jecting together the two organisms hemolyt staphylococcus and nonhemolytic streptococc When these were injected separately, no ulc followed.

Dr. William Lusk, who was in charge of th ward for patients with contagious diseases Belleview Hospital when I was serving my in ternship, used to order me to make incisions certain highly edematous areas in cases of er sipelas to prevent necrosis and slough. It is po sible that intense edema from infection plus po circulation plus poor nourishment of tissues m all play a part in causing gangrene. The exa mechanism is still in doubt.

Case 1.—A man aged 52, a former superintendent a factory producing agricultural implements, came the Pasadena Dispensary, Dec. 3, 1929, complaini of bad breath of seven months' duration. A daught died of diabetes at the age of 13½. The patient had h sugar in the urine since 1925, first discovered duri a search for the cause of a loss of 30 pounds (13.6 Kg in one month. About April 1, 1929 (eight month before coming to the dispensary) he became drowsy an went to his family doctor. The sugar content of the uri was high; the reaction for acetone and diacetic ac was 2 plus. He was given irregular doses of insulin, wi relief of symptoms. Ten days later he was sent to th Huntington Memorial Hospital because of ulceration the roof of the mouth, exophthalmos of the left eye an double vision at times. On admission the blood sug amounted to 308 mg. per hundred cubic centimeter His temperature was normal. The white blood ce

10. Millet, J.: Diabetic Gangrene of the Face, J. A. M. A. **112**:1143 (March 24) 1939.

11. Goldberg, S. A.: Gangrene and Infection of the Ear, Nose and Throat Complicating Diabetes Mellitus, Arch. Otolaryng. **42**:16 (July) 1940.

12. Warren, S.: Pathology of Diabetes Mellitus, Philadelphia, Lea & Febiger, 1938.

13. Riven, S. S.: Dermatitis Gangrenosa: A Compl cation of Diabetes Mellitus, Am. J. M. Sc. **189**:5 (April) 1935.

14. Brewer, G. E., and Meleney, F. L.: Progressi Gangrenous Infection of Skin and Subcutaneous Tissue Following Operation for Acute Perforative Append citis, Ann. Surg. **84**:438 (Sept.) 1926.

was 6,100. The ulceration of the hard palate ssed; the eye remained about the same, with con- ble swelling of the cheek. Roentgen examination skull for a possible tumor of the brain revealed but showed the left antrum dark and the left id cells hazy. Consultation at this time with Dr. Henninger showed the fundus of the left eye l, and no pain on pressure over the eyeball; thalmos was still present. The Wassermann test negative. The patient gradually improved on n, the temperature never going higher than 99.2 F. y time. The exophthalmos gradually subsided, t the end of three weeks the eye was about l. He was sent home with orders to report to hysician. The patient did not report to his phy- and went without medical care for seven months. g this time he had continually a foul breath, and this symptom that brought him to the dispensary,

. 1 (case 3).—Fistula in the left antrum photo- ed five months after the onset of diabetic gangrene.

e I saw him for the first time. He stated that his leaving the hospital fluids taken into the h had been entering the nose. An oval plate of n necrotic bone was exposed in the left side of ard palate, measuring about 3 by 1.5 cm. The naris was almost filled with black, foul-smelling tic tissue. The odor was much worse than that bad case of atrophic rhinitis. The right naris and septum were normal. The necrotic tissue was ved at one sitting with thumb forceps. No anes- was necessary. Bleeding was slight. After its val I found that most of the lower turbinate, all e middle turbinate and all of the visible ethmoid had come away, and the large cavity remaining ared to be lined with healthy epithelium. The of necrotic bone was removed from the hard e, leaving a perforation through which one could t two fingers from the mouth into the nose. The nt was referred to the medical clinic for control of diabetes and to the dental clinic, where a plate was made to close the perforation through the hard palate. He was followed for a year during which time he was healthy. He died following an automobile accident about a year after the time I first saw him.

Case 2.—Mrs. R. K., aged 47, was admitted to the Los Angeles County Hospital Aug. 5, 1938. She had been known to be diabetic for four years and had been

Fig. 2 (case 3).—Fistula from the mouth into the left antrum.

given an insulin regimen but had not followed the diet prescribed for "some time." During the week preceding admission she had a cold and for two days before admission swelling of the left eye. Examination showed the left eye rather edematous and red, with slight congestion in the nose. The blood sugar on admission amounted to 488 mg. per hundred cubic centimeters with the carbon dioxide-combining power 25 volumes per cent, the white cell count 11,600, the hemoglobin content 87 per cent, the blood pressure 90 systolic and 70 diastolic, and the Wassermann test negative. The patient was semicomatose and drowsy

Fig. 3 (case 3).—Material removed two months after the onset of diabetic gangrene.

at first, answering questions with difficulty. The diagnosis on admission was cellulitis of the eye, diabetic acidosis and acute heart failure. August 8 a neurologic consultant suggested that there might be thrombosis of the cavernous sinus. The temperature, however, had remained rather low. August 9 the patient was seen by me for the first time. There was at that time a dark

blue, almost black, color to the area below the left eye, which immediately suggested gangrene. This area was sharply demarcated. The left side of the nose was congested, but no pus was visible. The left side of the hard palate was swollen and dark blue. The next day a small ulcerated area on the left side of the temple was noticed. The patient said she felt fine and had no pain. The diabetes seemed under control. August 11 she was more stuporous and unable to swallow. The blood pressure remained low, and edema of the lungs began to develop. The heart tones were of poor quality. The gangrenous area on the left side of the hard palate was becoming more sharply demarcated. The patient died August 12, seven days after admission. Unfortunately permission for an autopsy was refused. The treatment consisted of injections of insulin, intravenous administration of dextrose and intravenous as well as oral administration of sulfanilamide.

CASE 3.—J. F., aged 69, was admitted to the Los Angeles County Hospital Sept. 13, 1943, complaining that he had experienced stabbing pains on the left side of the face for a week. The onset was gradual. The diagnosis of diabetes had been made in 1939. He had never been given an insulin regimen. For three months he had been weak, and for the last two weeks he had been dizzy and drowsy. One leg had been amputated for supposed carcinoma about twenty years before. The examination on admission showed under the left eye a red swollen area with a sharply demarcated area which gave the impression of erysipelas. Sulfathiazole was given. There were a number of small pink spots on the roof of the mouth. September 29 an ulcer developed under the left eye extending to the region of the lacrimal sac and the left side of the nose. The posterior pa the left alveolar process had become necrotic fo area of 1½ inches (about 4 cm.). A surgical consu at this time suggested carcinoma. Biopsies t September 29 and October 21 were reported as ne tissue with no evidence of cancer. October 29 patient was seen by me for the first time, and a d nosis of diabetic gangrene was made. The ulcer w had formed under the left eye had penetrated into left antrum and the nose, forming an opening a ¾ inch (2 cm.) in diameter. The alveolar process lost the soft tissue entirely. The bone, however, still firmly attached. This was allowed to loosen sp without treatment, and November 17 the entire pro was lifted out with a hemostat, leaving an ope into the floor of the antrum large enough to admit fingers. There was no bleeding. It was recommen that when the edges of the opening had healed, a de prosthesis be made to keep food from entering antrum. The patient's diabetes was under control his general condition became gradually worse, and spite of control by insulin, he died April 6, 194 bronchial pneumonia. Permission for an autopsy refused.

SUMMARY

The 15 cases of diabetic gangrene involv the head reported in literature and the 3 cases presented teach that infection in a pa with diabetes is dynamite and should be tre carefully.

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Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

CHRONIC PROGRESSIVE DEAFNESS, INCLUDING OTOSCLEROSIS AND DISEASES OF THE INNER EAR

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CHICAGO

The literature for 1943 on chronic progressive ness is noteworthy for the continued interest Ménière's disease and for articles by Day Goodyear presenting a new surgical treat- for this condition. The literature is re- ed in the following order:

clerosis:
Pathology and Etiology
Medical Treatment of Otosclerosis
Surgical Treatment of Otosclerosis
nic Adhesive Deafness
ary Nerve Deafness
Nerve Deafness from Acoustic Trauma
Nerve Deafness from Miscellaneous Causes
Nerve Deafness from Drugs
Treatment of Nerve Deafness
Ménière's Disease

OTOSCLEROSIS

athology and Etiology.—Spira [1] suggests that clerosis may be the result of fluorosis, which fferes with the function of the parathyroid ds. The facts that a disturbance of laby- nine equilibrium occurs in parathyroidec- ized rats, that the incidence of otosclerosis that of fluorosis are both high in England that some investigators have found serum ium lowered in 84 per cent of patients with clerosis are adduced as evidence in favor of hypothesis. (Comment: A novel theory, d on extremely flimsy evidence.)

Kelemen [2] describes the histologic observa- s in an ear with congenital deformity of the cle, occlusion of the external auditory canal, nce of the drum membrane and absence of sner's membrane, Jacobson's nerve, the ten- of the stapedius muscle and the chorda pani nerve. The remaining structures of the were rudimentary. A typical young oto- otic focus was found near the annular liga- t. (Comment: Since otosclerotic foci can be found in 5 to 10 per cent of all adults, the focus in this case must be regarded as coincidental and not necessarily related to the malformations.)

Kelemen [3] concedes that the occurrence of an otosclerotic focus outside of the labyrinthine capsule is exceedingly rare. He then describes such a focus lying between two pneumatic cells of the tegmen tympani of a boy of 14 who died from an osteomyelitis of the frontal bone. (Comment: Histologically, otosclerosis is similar to the formation of bone callus in response to injury. There is a question whether such areas of new bone occurring outside the labyrinthine capsule should be called otosclerosis, since they probably have nothing to do with the well defined clinical and pathologic entity known as otosclerosis.)

Benesi [4] describes the histologic observations in a case of unilateral otosclerosis in a patient whose hearing, according to friends, had been essentially normal. The focus surrounded the anterior half of the oval window and bordered the scala vestibuli of the cochlea and the macula cribrosa of the utricle. Its dimensions were 2.6 mm. anteroposteriorly, 2.5 mm. laterally and 4.5 mm. vertically. It was composed of three types of bone: compact dense bone, bone containing many marrow spaces of different sizes, and a vascularized portion. (Comment: Another instance of histologic otosclerosis without clinical otosclerosis, a condition now known to be four to eight times as frequent as clinical otosclerosis with ankylosis of the stapes.)

Benesi [5] reviews some of the theories on the origin of otosclerosis and presents his own theory that otosclerosis is due to the continued presence

1. Spira, L.: The Etiology of Otosclerosis, J. ng. & Otol. **58**:151-157 (April) 1943.

2. Kelemen, G.: Malformation Involving External, dle and Internal Ear with Otosclerotic Focus, Arch. aryng. **37**:183-198 (Feb.) 1943.

3. Kelemen, G.: Otosclerotic Focus Outside the Inner Ear Capsule, Laryngoscope **53**:528-532 (Aug.) 1943.

4. Benesi, O.: A Case of Unilateral Otosclerosis with a Microscopic Description of the Focus, Laryngoscope **53**:17-26 (Jan.) 1943.

5. Benesi, O.: Some Factors Involved in the Development of Otosclerosis, Laryngoscope **53**:343-346 (May) 1943.

in the labyrinthine capsule of blood vessels which normally would have been obliterated. A continuation of growth beyond normal limits represents the start of the otosclerotic focus, and secondary factors accelerate this growth. The author concludes that his idea is theoretic and should be supported by a study of the temporal bones of newborn children of otosclerotic descent.

Farber and Margulis [6] in a study of a family of 52 members found 12 with blue scleras, 7 with blue scleras and brittle bones, and 4 with blue scleras, brittle bones and deafness. No special study was made of the hearing defects.

Brunner [7] reviews some clinical and pathologic impressions gained from 17 cases of otosclerosis examined clinically and pathologically. He believes that the influence of pregnancy on otosclerosis has not been conclusively proved and that each case should be handled individually. (Comment: As we have pointed out in previous reviews, the influence of pregnancy on otosclerosis has been frequently overestimated. In our experience only about 1 of every 4 pregnancies in otosclerotic women results in a noticeable permanent acceleration of the loss in hearing.)

Rosenberger [8] reports in detail the cases of identical twins with otosclerosis. Adopted twin girls, aged 13, were seen by him at the age of 2 for removal of the tonsils and adenoids and again eleven years later because of failing hearing. There was no family history of deafness. Audiograms taken at the ages of 13, 16 and 17 showed a slowly progressive impairment of hearing in both ears which was of the same degree and the same rate in both twins. Noteworthy were the progressive loss of hearing with each infection of the upper respiratory tract and the high incidence of such infections in these twins. A similar observation was made in the twins studied by Shambaugh, Hagens and Fowler. The author concludes that the occurrence of a similar otosclerotic process in his identical twins points to heredity as a factor in this disease.

Medical Treatment of Otosclerosis.—Guggenheim [9] urges the prophylaxis of nerve deafness by supplementing the diet of aging persons and dieting women with vitamins. To prevent otosclerosis an early diagnosis of the disease should be made so that these persons may avoid having children and particularly so that 2 otoscle persons will not marry and have children. to treatment, the author reports results group of 36 children treated for hearing de by direct adenoidectomy and dilation of eustachian tubes; there was an average hea gain of 39.8 decibels. He treats otosclerosi a diet adequate in calcium, phosphorus and mins, and its neural degenerative compo with insulin, thiamine hydrochloride and nico acid. In a series of 4 cases diagnosed as stances of otosclerosis and 4 cases diagnose questionable instances of otosclerosis and lowed for from ten months to six years with treatment, the hearing remained essentially changed (within 10 decibels of the pretreat level) in 5, showed a gain in one ear onl 2 (15 and 14 decibels) and improved in ears (16 and 13 decibels) in 1. (Comment: pathologic process of otosclerosis must be garded as essentially irreversible, and there significant hearing gains are not to be expe from medical treatment. Whether or not progressive loss of hearing can be prevente medical treatment will be demonstrated onl following patients with clinical otosclerosi an early stage for a long period, half of t treated and half of them untreated as contr

Surgical Treatment of Otosclerosis.—Gug heim and Guggenheim [10] studied the effect various chemicals applied to fistulas made i skulls of rabbits, to prevent osteogenesis. A copper wire inserted and painted with a s rated solution of copper sulfate, a saturated tion of copper sulfate alone, a copper wire a a 10 per cent solution of silver nitrate, a s rated solution of trichloroacetic acid and a 10 dilution of saturated copper sulfate solu were all used. The authors found that sufficiently caustic chemicals, such as trichl acetic acid, there was no fibrosis and regeneration was completely inhibited. H ever, such caustic agents do not appear t suitable for practical surgical application to labyrinth. (Comment: To inhibit bone regen tion by the application of destructive agents, as chemicals or electrocautery, approaches problem from the wrong end, for such agent only by killing the superficial osteogenic and such death of tissue always results in in tion with extensive fibrosis, with or wit later formation of bone. The inhibition of regeneraton in the fenestration operation depend on producing a fistula with a mini of irritation of tissue so that the normal st lants to osteogenesis are lacking. This inclu perfect asepsis; leaving the bone surface smo

6. Farber, V. E., and Margulis, A.: Blue Scleras, Brittle Bones and Deafness, Arch. Int. Med. **71**:658-665 (May) 1943.

7. Brunner, H.: Otosclerosis, Laryngoscope **53**:736-742 (Nov.) 1943.

8. Rosenberger, H. C.: Otosclerosis in Identical Twins, Arch. Otolaryng. **38**:594-596 (Dec.) 1943.

9. Guggenheim, L.: Therapy of Deafness: Report of Cases, Laryngoscope **53**:441 (July); 503 (Aug.); 571 (Sept.); 653 (Oct.) 1943.

10. Guggenheim, P., and Guggenheim, L.: Bone tula, Arch. Otolaryng. **38**:139-147 (Aug.) 1943.

mplete removal of bone fragments and bone st, and avoidance of hemorrhage beneath the aneous flap by the close application of a thin with perfect hemostasis. Finally, and most portant, the peculiarly inert character of the chondral layer of the capsule with its tendency to form new bone is taken advantage of by wide removal of the periosteal layer of the sule for a distance of 2 to 5 mm. around fistula. With this technic only about 5 per t of fistulas have closed with loss of the provement in hearing after one year.)

Ruis [11a] describes a fenestration technic modified from that of Lempert and Shambaugh, with ee main modifications: the use of a simple icoantrotomy without mastoidectomy; irrigation with a solution similar to perilymphatic id; the use of an ivory implant to avoid closure the fistula.

The endaural approach is used, with incisions sely resembling Lempert's. The antrum is ened, the attic is opened with a burr, the incus d the head of the malleus are resected, a aneous flap similar to Lempert's is made, and fistula is then made over the roof of the tibule with use of a binocular microscope and ntinuous irrigation. After sulfathiazole powder s been insufflated into the operative cavity, the p is placed and then held in position with packs. The solution used for irrigation is isotonic ution of three chlorides U. S. P. without dexse but with 100 cc. of plasma to the liter added equal the albumin content of normal perinph. Sulfathiazole solution, 5 per cent, is then ded, 15 cc. or more to the liter of fluid.

The use of a small ivory implant to prevent sure of the fenestra is not described in detail, are the cases in which this was practiced inded, because the author does not think it wise reveal the results at present.

The author presents his results in a complete lion in a table.[11b] The results are expressed terms of decibels gained or lost for the three ech frequencies 512, 1024 and 2048. Of 16 ients who underwent fenestration by the techdescribed, 3 experienced a significant hearing n as follows: 1 (case 8) had a gain of 21 decis ten months after operation; 1 (case 9), a n of 11.6 decibels nine months after operation; (case 10), a gain of 15 decibels nine months er operation. Of the remaining 13 patients, 7 owed either no significant change (their hear is within 10 decibels of the preoperative el), 4 underwent a further loss and 2 were lost track of. (Comment: Although the author's series is not large and his percentage of successful results not high, nevertheless he has succeeded in substantially improving the hearing in 3 of 16 patients with otosclerosis, and this is more than can be said of any medical treatment for this condition. His use of an irrigating fluid resembling perilymphatic fluid, rather than ordinary isotonic solution of sodium chloride, may be a distinct advantage and contribution.)

De Lima [12] describes a new pathway into the attic for the fenestration operation. After an endaural incision, a pyramidal entrance into the attic is made without opening the antrum. A tympanomeatal flap is made, similar to Lempert's; the incus and the head of the malleus are exposed, and a fistula is made into the external horizontal canal according to Lempert's nov-ovalis technic.

De Lima [13] reviews the work of Kessel, Bárány, Sourdille, Lempert and Shambaugh and presents 2 cases in which he operated, with the preoperative and postoperative audiograms. In each case Lempert's technic was employed. In neither case was there a hearing improvement following operation.

Smith [14] reports the results of 32 fenestration operations, 18 according to Lempert's original technic and 14 according to Lempert's nov-ovalis technic. Revisions were done in 3 of the first 18 cases because of bony closure. Audiograms of 11 cases are presented and show the data set forth in table 1.

TABLE 1.—*Data on Eleven Cases in Which Morriset-Smith [14] Performed Fenestration for Otosclerosis*

Case	Preoperative Level for Speech, Decibels Below Normal	Postoperative Level for Speech, Decibels Below Normal	Time After Operation	Hearing Improvement, Decibels
1	55	31	1 yr. 2 mo. After revision	+24
2	66	36	1 yr. 9 mo.	+30
3	65	40	1 yr. 11 mo.	+25
4	57	31	1 yr. 6 mo.	+20
5	56	39	1 yr. 4 mo.	+15
6	49	34	9½ mo.	+15
7	58	20	8 mo.	+38
8	50	33	6 mo.	+17
9	41	25	5½ mo.	+16
10	53	26	3 mo.	+27
11	50	30	3 mo.	+20

11. Ruis, M.: (*a*) The Perilymphatic Space of the , Montevideo, Uruguay, Editorial Mosca Hermanos, 3; (*b*) pp. 376-379.

12. de Lima, E.: Anatomical-Surgical Study of a New Supra-Meatal Approach for Otosclerosis, Rev. med.-cir. do Brasil **51**:101-108 (Jan.-March) 1943.

13. de Lima, E.: Surgical Treatment of Otosclerosis, Rev. brasil. de cir. **12**:247-255 (March) 1943.

14. Smith, J. M.: The Fenestration Operation for Otosclerosis, Arch. Otolaryng. **37**:174-182 (Feb.) 1943.

The author considers a good result to be the restoration of hearing for the normal speech range, and he regards a gain of 10, 20 or 30 decibles as of no value to the patient unless the gain reaches the practical threshold of ordinary conversation. If the improvement lasts over eight months, the result is considered permanent.

The author concludes that with proper asepsis and technic this surgical procedure can be performed without undue risk and that the results justify in every way the continuation of this research. (Comment: The author does not present the results in his remaining 21 cases, but presumably they were inferior to those of the 11 cases presented. He does not specify what he considers the level of hearing "for the normal speech range." If he agrees with Lempert that the hearing for speech must be brought within 30 decibles of normal, and if only the cases in which the operation was performed eight months ago or longer are considered, a good result was obtained in only 1 case (case 7) of the series of 32. However, it is the experience of one of the reviewers (G. E. S.) that a 30 decibel improvement in hearing often appears to mean as much to a patient with a preoperative loss of 75 decibels as to a patient with a preoperative loss of 60 decibels. By all means bring the hearing up to a 30 decibel loss or better if possible but do not deny the operation to those whose hearing can be brought from a 70 or 75 decibel loss to the 40 or 35 decibel level. Many persons with such gains will find that they can hear without a hearing aid better than they could hear with a hearing aid before operation and will consider the operation very much worth while. If the postoperative level alone is considered the measure of the operator's success, patients with a preoperative loss of 30 to 35 decibels could be adjudged to have a good result with insignificant gains of only a few decibels. *Both* the decibel improvement and the final hearing level should be considered in judging whether or not the operation is a success. For purposes of comparative analysis of technics the number of decibels of improvement for speech would seem to be the most satisfactory means of comparing results, for audiograms taken on different machines, in different offices, by different operators, will often vary more than 10 decibels.

This article by Morriset-Smith deserves special attention because the author's reputation for successful surgical treatment of diseases of the mastoid process is well established. In a way this article represents the arrival of the fenestration operation as an accepted otologic procedure for the treatment of otosclerosis.)

Sullivan [15] agrees with Shambaugh that L pert has made a monumental contribution otology in devising a practical one stage op tion for otosclerosis. On the basis of his ex ience in operating on more than 75 patients concludes that failure in the operation may due to:

1. Failure to perform meticulously each succes step in the operation—one mistake is invariably f
2. Selection of cases of an improper type.
3. Lack of precision in making the fistula an careful molding and placing of the flap over the fi
4. Failure to recognize damage to the membra labyrinth at the time of fistulization.

The author does not specify his results o than to present the preoperative and postop tive audiograms of 7 cases, which reveal the d shown in table 2.

TABLE 2.—*Data on Seven Cases in Which Sulliv Performed Fenestration for Otosclerosis*

Case	Preoperative Level for Speech, Decibels Below Normal	Postoperative Level for Speech, Decibels Below Normal	Time After Operation	Hear Impr ment Decib
1	45	23	7 mo.	+8
2	51	23	1 yr. 4 mo.	+8
3	52	21	2 yr.	+9
4	49	23	3 yr. 6 mo.	+9
5	48	31	1 yr. 6 mo. After revision	+7
6	53	20	6 mo. Nov-ovalis technic	+2
7	56	20	2 yr.	+3

(Comment: The excellent results in the few c reported by the author are noteworthy, but w out a complete report of the results, good bad, in all the cases, one cannot in any evaluate the operation.)

Fabricant [16] reviews the literature on the s gical treatment of otosclerosis from Kessel to present day.

Shambaugh [17] reviews the treatment of d ness, including the use of the fenestration op tion for otosclerosis. The problem of maint ing the patency of the new window has b largely solved by:

1. Maintenance of strict surgical asepsis throug the operation and in the after care.
2. Use of an irrigating apparatus during the op tion to keep the window immaculately clean and from bone dust and blood.
3. Use of dental polishing and burnishing burs produce a perfectly smooth polished bone surface.

15. Sullivan, J. A.: Surgery of the Mastoid, A Otolaryng. **37**:845-851 (June) 1943.

16. Fabricant, N.: Surgical Treatment of Oto rosis, Am. J. M. Sc. **205**:604-610 (April) 1943.

17. Shambaugh, G. E., Jr.: Deafness or Impa Hearing, J. Michigan M. Soc. **42**:525-529 (July)

Covering of the window with a thin periosteum-cutaneous flap.

s a result of experience in 261 operations a period of four years the author finds that ures usually occur within six months, so that ing improvements over this period can be rded as probably permanent. With the tech-ow used (Lempert's nov-ovalis technic with tant irrigation and use of the operating mi-cope while the fistula is being made) prob-permanent improvement in hearing is ob-d in 90 per cent of cases. In 1 or 2 per cent, operation results in a further loss of hearing.

CHRONIC ADHESIVE DEAFNESS

merson and Dowdy [18] applied radium to the ce of the eustachian tube on applicators in 30 ted cases of chronic otorrhea with hyper-hy of lymphoid tissue in and about the achian orifice. A single small dose, approxi-ely one third of an erythema dose (5 milli-hours), was administered. In 4 cases the membrane healed; in 5 cases the otorrhea rred. Pretreatment and post-treatment ograms of 4 cases showed gains of 11 to 49 bels for speech. The authors conclude that ingle small dose of radium gives relief from discharge with improvement of hearing in ted cases of chronic otorrhea. (Comment: obvious that this treatment can be effective when the otorrhea is tubal in origin, that is, ases with an odorless mucoid discharge and ntral perforation. In cases of mastoid osteitis cholesteatoma the application of radium to nasopharynx cannot be of help. Therefore petent otologic examination must precede treatment.)

cobson [19] observed an apparent improvement earing in a patient with Hutchinson's triad intramuscular administration of 0.33 to 1 a 3.2 per cent solution of benzyl cinnamate. he basis of this observation the drug was ad-stered to 32 patients for deafness, 17 of m stated in answer to a questionnaire that were improved. In 6 of them the hearing oved 10 to 25 decibels for speech, in 7 the ing improved 6 decibels, and in 4 the gain less than 6 decibels. The author is not yet to state the form of deafness most amenable his treatment, but at present the chronic rhal inflammatory lesions of the middle ear conductive deafness point to encouraging results. (Comment: In the evaluation of any form of therapy for deafness forms of self-limited impairment of hearing, such as secretory otitis media or subsiding acute otitis media, must be separated from those forms of deafness, such as nerve deafness or otosclerosis, in which spontaneous improvement without treatment cannot be expected. The author's failure to specify the diagnosis of the type of deafness in each case renders his report of doubtful value.)

PRIMARY NERVE DEAFNESS

Nerve Deafness from Acoustic Trauma.—Wilson [20] regards acoustic fatigue as a protective mechanism decreasing the sensitivity of the ear during loud sounds. The relation between acoustic fatigue and irreversible hearing loss due to acoustic trauma was studied among 85 inductees of the Army. Acoustic fatigue was tested for by using a tone of 256 cycles at 80 decibels of intensity for five to eight minutes and then taking an audiogram. Each man was later retested by taking an audiogram within fourteen hours after the completion of his basic training of two to three days on the pistol and rifle range. The author found that the persons more susceptible to acoustic fatigue are also more susceptible to irreversible acoustic trauma. It is thus possible to determine in advance those who are predisposed to traumatic deafness. Such a means of screening out susceptible persons should be of great value in noisy industries.

The author also found that persons with impaired hearing are more susceptible to acoustic trauma than those with normal hearing.

Suggit [21] classifies deafness from gunfire and explosions into three types:

1. Middle ear deafness, due to rupture of the drum membrane and bleeding, with recovery in an average of twenty-five days, provided no infection occurs.

2. Gradual high tone loss as the result of exposure to gunfire over a period of years, with the 4096 depression characteristic of occupational deafness.

3. An abrupt high tone loss as the result of a single sudden explosion, the sudden drop occurring either between 1000 and 2000 cycles, or 2000 and 4000 cycles, the vertical drop lying closer to the lower frequencies in the more severe injuries. The author calls this type of deafness "concussion deafness." Audiograms from 8 cases of concussion deafness are included in the article.

(Comment: We have observed occasional cases of the abrupt island type of deafness occurring in civilian life after exposure to a sudden loud

Emerson, E., and Dowdy, A. H.: Radium Therapy as an Aid in Control of Chronic Otorrhea, Am. Roentgenol. **49**:234-239 (Feb.) 1943.

Jacobson, J.: Treatment of Certain Forms of Deafness by Means of Benzyl Cinnamate, Arch. Otolaryng. **38**:365-368 (Oct.) 1943.

20. Wilson, W. H.: Prevention of Traumatic Deafness, Arch. Otolaryng. **37**:757-767 (June) 1943.

21. Suggit, S.: Deafness Resulting from Gunfire and Explosions, J. Laryng. & Otol. **58**:313-326 (Aug.) 1943.

noise, similar to the cases of concussion deafness described by Suggit. It seems reasonable to assume that in such cases the sudden loud sound has caused a mechanical tearing of the vibrating membranes in a portion of the organ of Corti, in contrast with the usual case of occupational deafness in which the hearing loss, beginning at 4096, is due to progressive degeneration of the nerve elements.

Lurie [22] exposed the ears of an experimental animal to a sound of 120 decibels and 500 cycles per second and immediately after the exposure noted a marked loss of hearing. Microscopic study showed that the organ of Corti had been thrown off the basilar membrane in a region near the helicotrema. This experiment was repeated many times with similar results. This is the type of acute traumatic deafness one may expect in wartime as a result of bursting shells and explosions. Deafness may also be the result of exposure to loud sounds over a long period resulting in degeneration of the hair cells.

The author believes that all persons subjected to loud noises in industry should have hearing tests at regular intervals to detect the possibility of beginning deafness. Long periods of rest at intervals may be necessary to prevent further loss; it may take at least a week for the human ear to recover from exposure to an intense sound. There is also marked variation in individual sensitivity to such sounds, and as a result no dogmatic stand can be taken that sounds of a certain intensity do not harm while others do.

Nerve Deafness from Miscellaneous Causes.—Sirles and Slaughter [23] note that the association between deafness and retinitis pigmentosa has been known for a long time. Of 12 patients with retinitis pigmentosa observed by the authors, 6, or 50 per cent, showed varying degrees of nerve deafness. The hearing defect was invariably bilateral. There was no constant relationship as regards onset or severity between the aural and the ocular symptoms. The authors conclude that a common defect of the germ plasm is present in the anlages of the inner ear and the retina in such cases.

Nerve Deafness from Drugs.—Forbes [24] reviews the relation of quinine to nerve deafness and suggests that quinidine is also a possible cause of aural symptoms. Two cases are presented, with audiograms. In the first c high tone loss of 40 decibels for 8192 is s with essentially normal hearing for all tones in this ear and for all tones incl 8192 in the opposite ear. In the second case is shown a loss of 30 decibels for 2048 inc ing to 50 decibels for 8192 in one ear; i other ear there is shown a loss of 35 de for 2048 increasing to 60 decibels for Both patients complained of tinnitus. ment: In the first case reported the fact the high tone loss was confined to one ear s against a blood-borne toxin such as quin which would be expected to affect both equally. The author's suggestion that quin a derivative of quinine, may cause a toxic deafness should be further studied in pa receiving this drug.)

Treatment of Nerve Deafness.—Babbitt ports the results of the use of prostigmine treatment of 37 patients with tinnitus. hearing was remarkably improved in 2, what improved in 7, unimproved in 2 worse in 4. Of the 9 patients showing imp ment, tinnitus was much relieved in 7.

Ménière's Disease.—Altmann and Fo describe in detail the histologic observati the ear in 3 cases of Ménière's syndrome. changes were the same as had previously reported in 10 other cases and consisted latation of the cochlear duct, with and w herniation into the helicotrema and bulgin the vestibule, and frequent distention saccule, the utricle and the ductus reunien slight bulging into the perilymphatic spa the ampullated ends of the semicircular especially the horizontal canal. The end phatic space of the semicircular canals re free from dilatation. Fibrosis of the "pe cular" tissue was present in all instances, bilateral. The maculae and cristae were instances normal. The organ of Corti s much postmortal change, making it imp to judge any pathologic features. The a regard Portmann's operation as the most p logic of the surgical therapies available.

Hallpike [27] believes that the gross changes in Ménière's syndrome occur wit labyrinth, not in the eighth nerve, in the of endolymphatic hypertension. This be based on his use of a modified Bárány test. With the patient lying comfortably

22. Lurie, M. H.: War and Deafness, Connecticut M. J. **7**:763-765 (Nov.) 1943.

23. Sirles, W. A., and Slaughter, H.: Pigmentary Degeneration of the Retina and Nerve Type of Deafness, Am. J. Ophth. **26**:961-966 (Sept.) 1943.

24. Forbes, S. B.: Quinine in Relation to Nerve Deafness, Ann. Otol., Rhin. & Laryng. **52**:109-125 (March) 1943.

25. Babbitt, J. A.: Problem of Impaired H Arch. Otolaryng. **38**:94-96 (July) 1943.

26. Altmann, F., and Fowler, E. P., Jr.: Hi cal Findings in Ménière's Symptom Comple Otol., Rhin. & Laryng. **52**:52-80 (March) 19

27. Hallpike, C. S.: The Investigation of M Disease, J. Laryng. & Otol. **58**:349-362 (Sept.

h with the head raised 30 degrees from the zontal, each ear is irrigated with hot and water at 30 C. and 44 C. for forty seconds constant and free rate of flow. The phenom- of "directional preponderance"—that is, agmus toward the right or the left side, ther induced by hot or cold stimulation of r ear, shows greater duration than nystag- induced toward the opposite side—was ent in 21 of 100 cases of Ménière's syn- me, with hypofunction of a canal in 49 cases normal responses in 12 cases.

runner [28] disagrees with the conclusion of thorne, Fitzgerald and Hallpike that direc- l preponderance in the caloric test in ière's disease is due to utricular paresis; holds rather that directional preponderance ue to a disturbance in the brain stem, not in labyrinth.

tkinson [29] separates his patients with ière's syndrome into those who are sensitive allergic) to histamine and those who are in- itive to histamine by means of intradermal with histamine. Of 20 histamine-sensitive nts with Ménière's syndrome, 10 also suf- d from migraine; of 88 nonsensitive ones, 12 migraine. In the histamine-sensitive (or gic) group the headache precedes the verti- whereas in the insensitive group the headache eeds it. Treatment of the histamine-sensitive p by desensitization to histamine relieved the headache and the vertigo. Treatment he insensitive group with nicotinic acid as a dilator relieved the headaches along with the iness. The author concludes that migraine, Ménière's syndrome, is due to vascular unction.

tkinson [30] studies patients with Ménière's rome neurologically, especially for a lesion he cerebellopontile angle; he examines for ture of the eustachian tube caused by swell- of the mucosal lining, and he removes any of infection in the nose and throat. On usion of patients with the aforementioned itions there remains an "idiopathic" group se symptoms are of allergic origin. To do with multiple cutaneous tests, which are iously unreliable, or trial and error in the of food allergies, which may result in im- nt starvation without other definite result, eats the patients of this group with histamine intracutaneously; the dosage begins with a cutaneous test dose of 0.0057 mg. of histamine base (0.01 mg. of histamine dihydrochloride) and is increased every two to four days to a maximum of 0.57 mg. of histamine base (1 mg. of histamine dihydrochloride), followed by a maintenance dose given at four week intervals. About one fifth of all patients with Ménière's syndrome are found to be histamine sensitive and are treated by this method. Of 63 patients treated, 12 who were sensitive to histamine were relieved of symptoms (vertigo) for six months. The patients who were insensitive to histamine were given 50 mg. of nicotinic acid intramuscularly and 50 to 100 mg. by mouth daily, and 20 gained relief from their symptoms for six months.

Rainey [31] treated 22 patients for Ménière's syndrome with histamine phosphate, 2.75 mg. of histamine diluted in a liter of isotonic solution of sodium chloride being given intravenously at the rate of 40 to 70 drops per minute. In 17 patients there were striking results, and these patients are now well and going about their daily tasks. Five patients had disappointing results.

Schick,[32] regarding Ménière's syndrome as a vasomotor disturbance similar to migrane, injected 5 cc. of a 50 per cent magnesium sulfate solution intravenously two or three times a week for ten to twenty injections. Of 18 patients thus treated, 7 had no spells during a control period of fourteen months, 7 had less frequent and milder spells, and 4 were unchanged. The author states that the theoretic basis for his treatment has not yet been established.

Moore [33] noted that of 20 patients with Ménière's syndrome 17 had disease of the nasal sinuses and 4 were allergic. The treatment consisted in vigorous catheteral inflation of the eustachian tubes, with bougienage of the tubes if the passage of air was not free, and in practically every case the vertiginous seizure was relieved. The allergic patients were referred to an allergist. The author concludes that Ménière's syndrome is caused by changes of pressure in the labyrinth. (Comment: It is now generally conceded that Ménière's syndrome is due to dilatation of the endolymphatic spaces. The great majority of authors have found no evi-

Brunner, H.: Neurology in Otolaryngology, ngoscope **53**:117-137 (Feb.) 1943.

Atkinson, M.: Ménière's Syndrome and Mi- e: Observations on a Common Causal Relation- Ann. Int. Med. **18**:797-808 (May) 1943.

Atkinson, M.: Diagnosis and Treatment of ière's Syndrome, Arch. Otolaryng. **37**:40-53 (Jan.)

31. Rainey, J. J.: Histamine in Treatment of Ménière's Syndrome, J. A. M. A. **122**:850-852 (July 24) 1943.

32. Schick, A.: The Treatment of Ménière's Syndrome with Magnesium Salts, Ann. Otol., Rhin. & Laryng. **52**:45-51 (March) 1943.

33. Moore, J. H.: Ménière's Syndrome, Laryngoscope **53**:519-527 (Aug.) 1943.

dence of pathologic changes in the middle ear or the eustachian tube in cases of this syndrome, nor does it seem reasonable to expect relief from dilatation of the endolymphatic space by tubal inflation.)

Goodyear [34] treated 4 patients for Ménière's disease by exposure of the membranous labyrinth of the horizontal and superior semicircular canals through a postauricular approach, in order to decompress the labyrinth. The opened semicircular canals were then covered with a cutaneous flap. In every patient the hearing completely disappeared following the operation, and in 3 dizziness was relieved for four months to one year. One patient had occasional attacks of dizziness over a period of four years. The author is now modifying the operation to include only the otolithic membrane of the utricle.

Cawthorne [35] describes an operation for Ménière's disease in which he exposes the membranous horizontal canal with the use of a dissecting microscope and a dental drill and then removes the membranous tube with a fine forceps. The procedure is indicated when little hearing is present and when conservative measures do not keep the symptoms in check. In the 52 patients operated on, there were no complications, and the wounds all healed by first intention. The author points out that there are no grounds for believing that section of the nerve will cause less disturbance than destruction of the end organ.

Day [36] does not agree that in the surgical therapy of Ménière's disease Dandy's sectioning of the vestibular nerve is a logical procedure, as it does nothing toward attacking the origin of the trouble—which is hydrops of the labyrinth. He recommends a partial simple mastoidectomy with the antrum and the aditus being opened widely until the short process of the incus is exposed. The horizontal canal is opened medially to the short process with a burr so that a light coagulating current may be passed by means of a fine needle through the ampulla of the canal into the vestibule. A few crystals of a sulfonamide compound are dusted into the cavity, and the mastoidectomy incision is completely closed with clips. This operation was done on 8 persons, 6 with unilateral and 2 with bilater volvement. Three years or more have el since operation in 6 of the cases. The r were as follows:

1. There was complete loss of response to stimulation in all cases.

2. Hearing remained essentially at the preop level in 2 cases.

3. Hearing in 1 case improved from a preop level of 70 decibels of loss to almost normal, wh has remained for one and one-half years.

4. Vertigo was relieved almost immediately in in others two to three months were required the other labyrinth was completely adjusted.

5. The results in 2 cases are described as those in 6, as good.

(Comment: Surgical destruction of the labyrinth bids fair to supplant section of eighth nerve in the treatment of Mèniére's ease, being safer and more easily perfor All authors agree that surgical interve should be reserved for those patients wh not respond to medical therapy. Unfortun there is no unanimity regarding medical the the very multiplicity of the procedures ad attesting to the relative ineffectiveness of or all of them. It would seem reasonable to patients with Méniere's syndrome by prelimi exclusion of those whose dizziness is due to bral vascular disturbance [fainting] and whose dizziness is due to tumor of the cere pontile angle or to some other disturban the central nervous system. Patients with curring attacks of genuine aural vertigo out otitis media, who may be regarded as ing the true Ménière's syndrome, sh have obvious foci of infection and definite allergic factor removed. If the sy toms persist after a reasonable time has ela Furstenberg's regimen may be applied as a ple and practical procedure. Horton's hista desensitization or Atkinson's histamine or tinic acid treatment may be used in case which relief is not given by Furstenberg's ment. In the few remaining patients w incapacitating attacks of vertigo persist and not been relieved by these forms of m therapy or have failed to clear up spontaneo surgical opening of the horizontal canal by technic of Day, Cawthorne or Goodyear sh be carried out. In evaluating the results of therapy of Méniére's syndrome the spontan remissions characteristic of the disease always be taken into account.)

34. Goodyear, H. M.: Ménière's Disease: Surgical Approach to the Labyrinth with Destruction of the Utricle; Case Report, Laryngoscope **53**:743-746 (Nov.) 1943.

35. Cawthorne, T. E: The Treatment of Ménière's Disease, J. Laryng. & Otol. **58**:363-371 (Sept.) 1943.

36. Day, K. M.: Labyrinth Surgery for Ménière's Disease, Laryngoscope **53**:617-630 (Oct.) 1943.

Abstracts from Current Literature

Ear

OLOGIC OTOSCLEROSIS. STACY R. GUILD, Ann. ol., Rhin. & Laryng. **53**:44 (June) 1944.

ld reports the incidence of histologic otosclerosis 61 patients. Sections of both ears were available 80.3 per cent of the patients. Forty-nine of the ts showed histologic involvement, with a total of rs involved. The 81 ears showed a total of 113 erotic areas, 64 of which were located anterior e oval window and 25 near the round window. of the areas were limited to the footplate of the and appeared to have originated there. Ankylosis e stapes had occurred in only 10 of the 81 ears. ears the otosclerotic area was less than 0.1 mm. the footplate, but no ankylosis had occurred. ng tests, including audiometric tests, had been of 55 of the 81 ears, and general information as hearing was obtained for all but 4 of the others. relating the histologic observations and the clinical ledge of these cases, Guild shows that in discussing erosis a clear distinction must be made between al and histologic otosclerosis, owing to the fact otosclerosis is often asymptomatic. The disease not cause impairment of hearing unless or until osis of the stapes occurs. Atrophy of nerve fibers e organ of Corti does not occur more often in with otosclerotic areas than in ears free from such When atrophy does occur in otosclerotic ears, usually limited to the basal turn of the cochlea differs in no way from the atrophy of nerve and rgan that is often seen in sections of ears with- otosclerosis.

sclerosis is primarily a disease of bone, and osis of the stapes is occasionally incident to it. clinical otosclerosis cannot be diagnosed without osis, a negative family history is of little impor- to the examiner. The histologic facts reported s paper indicate that it would be useless to try minate otosclerosis by eugenic measures, as all sions with respect to dominant and recessive that have been drawn from clinical studies of heritance of otosclerosis are rendered invalid by formation gathered. The study also shows that eral otosclerosis is not infrequent, that otosclerosis more frequently in the white race than in es and that in the white race females are more involved than males.

M. V. MILLER, Philadelphia.

STIC TRAUMA OF THE ORGAN OF CORTI IN THE INEA PIG. M. H. LURIE, H. DAVIS and J. E. AWKINS JR., Laryngoscope **54**:375 (Aug.) 1944.

e ears of 200 guinea pigs were exposed to sounds gh intensity. The organ of Corti was tested and d either immediately or some days after the a.

e tones produced damage to the cochlea but none utricle, the sacule or the middle ear.

tions of the cochlea may show damage to the al hair cells, stripping of the mesothelial cells under the basilar membrane, sometimes damage internal hair cells, separation of the organ of from the basilar membrane or a break in the continuity of the organ of Corti and, with the severest trauma, a complete disappearance of this organ.

The damage done is directly proportional to the intensity and the duration of the sound.

The location of the maximum damage varies with the pitch of the tone to which the ear is exposed. The higher the pitch, the closer is the damage to the round window. The more intense the sound, the wider is the area of damage.

The damage is permanent. Progressive degeneration of the organ of Corti and later of the nerve fibers and cells of the spiral ganglion takes place.

The hearing loss is proportional to the pathologic change, although similar changes do not necessarily produce the same degrees of loss.

HITSCHLER, Philadelphia.

OTOLARYNGOLOGIC PROBLEMS OF AVIATION. PAGE NORTHINGTON, New York State J. Med. **44**:1055 (Aug. 1) 1944.

Dr. Northington's contribution was read before the New York State Medical Society at the meeting in Buffalo in May 1943. Flying problems concern not only flyers but all who journey by air. After such a trip passengers visit their physicians with various complaints, which are not always familiar to the latter. During World War I the Bárány tests were said to be indicative of flying ability because the static labyrinth was an indicator of position in space. Now the thought is that the tests were and are good but that the interpretation is often wrong. Today otologists depend on the Romberg sign and the test of standing on one foot with eyes closed. If the results of these tests are not satisfactory, one must find out why. No applicant is to be considered for flight training who has a history of vertigo or who is inordinately disturbed by tests at examination. After a radical mastoidectomy, blasts of cold air against the tympanic wall may lead to disaster. Airsickness is still a problem, like seasickness, but can be partially controlled by bromides, barbiturates or atropine. The last is probably the best. "Passengers who have planned a flight, especially if they suffer from airsickness, should avoid constipation and excesses in the consumption of alcoholic beverages and should have a good night's sleep before a trip." Earache is common in pilots. The cure is to ascend 1,000 feet, yawn and stretch the jaw muscles by moving the mandible from side to side. The appearance of the tympanic membrane is deceptive. One may find blood in the meatus without a perforated membrane. Osmosis through the membrane is easy at certain altitudes. Tubal obstruction may be relieved by the experiment of Valsalva but never in the presence of a cold. After a person has taken a sulfonamide drug, he should be grounded for from two to six days.

There is so much mental pabulum in this article that it will well repay a careful reading.

VOORHEES, New York.

REPORT OF EIGHTY-FIVE FENESTRATION OPERATIONS FOR OTOSCLEROSIS. J. MORRISSET SMITH, New York State J. Med. **44**:1771 (Aug. 15) 1944.

This is the second report Smith has made concerning his experiences with fenestration. It was read at the

annual meeting of the New York State Medical Society in New York, May 11, 1944. The first report concerned 32 operations; this one includes 53, making 85 in all. He concludes that "the fenestration operation is a thoroughly established surgical procedure capable of restoring practical and lasting hearing in selected cases." Eighty-five operations without death or complications lead to the opinion that there is no "undue risk" in experienced hands. There is real danger, however, if an operator is untrained in this technic. Work must first be done on cadavers, and the intricate steps of the operation must be thoroughly learned. A successful fenestration restores practical hearing and arrests otosclerosis. Otologists are urged to carry out research in this operative field. Six patients who had undergone the fenestration operation were shown with their hearing records, both those taken before and those taken after operation. The longest lapse of time after this procedure was nearly four years; the shortest, four months. Dr. James A. Babbitt, of Philadelphia, in his discussion, stated that "fenestration fills a serious gap in our therapeutic regimen. . . . This has been a clearcut, finely prepared paper and, after hearing it, we believe the fenestration window will not close."

VOORHEES, New York.

Pharynx

THE RELATIONSHIP OF TONSILS AND ADENOIDS TO THE TYPE OF POLIOMYELITIS: AN ANALYSIS OF FOUR HUNDRED AND THIRTY-TWO CASES. PASCAL F. LUCCHESI and ALFRED C. LABOCETTA, Am. J. Dis. Child. **68**:1 (July) 1944.

The material for this study was found in the Philadelphia Hospital for Contagious Diseases. The authors go back to reports issued by Ayer in 1928 and Aycock and Luther in 1929, who recorded instances of poliomyelitis subsequent to recent tonsillectomy. In their own study they do not stress recent removal; "the purpose is to determine the relationship that the presence or absence of tonsils bears to the type of disease acquired and to mortality." Others have tried to find out whether the lack of adenoids and tonsils is responsible for involvement of the "higher centers." In other words, do adenoids and tonsils protect or leave the basilar nervous system open to infection? In "Summary and Conclusions" they state that "the incidence of bulbar and bulbo-spinal poliomyelitis was significantly higher in patients without than in patients with tonsils and adenoids." The mortality was ten and nine-tenths times greater in bulbar than in nonbulbar types. "It is recommended that tonsils and adenoids be not removed unless the removal is specifically indicated." Does this mean that otolaryngologists are not to perform adenoidectomy or tonsillectomy, hoping thereby to remove the danger to children who might be infected by poliomyelitis? In view of the tremendous improvement in the condition of many children after these operations it is hard to accede to this advice. Physicians in the presence of any epidemic ordinarily do not recommend operations which can be postponed. Opening new pathways of infection is too obvious. It is yet to be proved, however, how much of a "barrier" this Waldeyer ring is to the incidence of poliomyelitis and perhaps to other conditions as well. The ring certainly affords highly suspicious sites for infections associated with rheumatic fever, and many think that these sites are the actual loci of the bacteria responsible for that heart-crippling disorder. The article seems not sufficiently conclusive.

VOORHEES, New York.

Nose

AEROSINUSITIS—ITS CAUSE, COURSE AND TREATM
PAUL A. CAMPBELL, Ann. Otol., Rhin. & La
53:291 (June) 1944.

Aerosinusitis is as definite an entity as aero-
media but occurs about one-twentieth as often.
sinusitis is caused by changes in barometric pres
or barometric trauma. It is commonly characterize
congestion and inflammation of the lining struct
Pain is usually present. Mucosal or submucosal he
rhage may occur. The condition may resul
temporary or permanent changes in the sinus m
membrane, depending on the amount of baro
trauma. A cavity such as a sinus when moved
a relatively high to a relatively low barometric
sure as in ascent will undergo alterations of itself
its contents in such a manner that equalization o
pressure of the gas and air inside the sinus wi
attained. During descent alterations take place
changes in the opposite direction. In the normal
with an unobstructed ostium the equalization of pre
during ascent and descent occurs without sensa
However, this situation is altered if there is an ex
of any type over the ostium or if the ostiu
obstructed with lymphoid tissue or because of ana
deformity. Campbell divides the involvement o
sinuses into two types, nonobstructive and obstru
Nonobstructive aerosinusitis is that in which a secr
is present over the ostium in such a position th
may be pushed away by relatively small change
pressure. In ascent this secretion is pushed away
the ostium, but in descent it is forced into the cavity
is a means whereby the sinus may become infe
Involvement of this type is treated as any other
tion of the sinuses and is treated in the same way

Obstructive aerosinusitis occurs when tissue b
the ostium. In this case the air or gas contents o
cavity are trapped, probably because of a flutte
ball-valve action. This usually occurs only d
descent, when inflamed tissue, a swollen turbina
a polyp is forced into the ostium so as to produ
airtight seal. Trapping rarely occurs on ascent. D
descent the vacuum which is formed must be co
sated for, and alteration of the structure and
contents of the sinus follows. The degree of alter
depends on the degree of the differentiation in pres
and the author states that there are three de
The first, second and third degrees vary from
slight involvement to that in which the lining mem
is stretched from the bone.

The frontal sinus seems to be involved more
than the other sinuses. The maxillary sinus is inv
occasionally, but the others rarely.

The treatment of the nonobstructive type consi
shrinkage which will allow aeration of the
External heat may be used. For the obstructive
the ideal treatment seems to be a return to the al
at which the block was formed, correction of th
struction, and then a slow return to ground level.
treatment can be carried out either in a pre
chamber or in a plane in actual flight. Both me
have been used successfully. One must, however,
the actual pathologic changes, as submucosal hem
stripping of the lining membranes and frank hemo
in the cavity will not be benefited by chang
barometric pressure and in fact may be exagge
Careful Proetz treatment has given good resu
some cases.

Five case histories are given.

M. V. MILLER, Philadel

Transmaxillary Subperiosteal Exposure of Lacrimal Pathways. Mario Rius, An. de rino-laring. d. Uruguay **13**:162, 1943.

describes in detail a modification which he has ed in the transmaxillary approach to the frontoal sinuses. This is indicated when the frontal ay be small or is obscured by a prominent ridge ascending ramus of the superior maxilla. In chnic he proceeds anteriorly and superiorly, re- the bone from the ascending ramus, and exposes rimal sac; working subperiosteally, he carefully s all the bone around the lacrimal sac so as injure the sac, and then makes an ascending e into the frontal sinus. In this way he has ble to curet the frontal and anterior ethmoidal easily. He has employed this technic in 2 ith complete cure.

Persky, Philadelphia.

gy and Pathology of the Deformities of the al Pyramid. Alfredo Alcaino, Rev. de otorraring. **3**:184 (Dec.) 1943.

no discusses nasal deformities from the physiand esthetic standpoints. He stresses the fact sal reconstruction should be done by the rhin-

ivides the nasal pyramid into two parts: the which constitutes the vertex, and the carti- which forms the base. The nasal septum is ided into two parts: a posterior bony portion, rticulates with the bony vertex, and an anterior inous portion, which articulates with the carti- base. Thus the nasal skeleton is divided into posterior portion and a movable anterior portion. hor believes that alterations in the development superior maxilla and of the palatine arches are ible for many of the nasal deformities. These s form the nasal floor and the hard palate. eformity produces a high palate with shortening ertical nasal diameter, which in turn prevents elopment of the nasal septum and this produces eviations.

deformities are: 1. External deformities: galia, hump nose, lateral deviation, and hyperof the nasal tip. 2. Internal deformities: septal ns altering the normal respiration, also narrow hich do not permit proper ventilation. 3. ities of the base; congenital or traumatic de- s of the columella. He also mentions the short p, which may cause an esthetic deformity when ent tries to close his mouth and thus pulls e tip of his nose.

Persky, Philadelphia.

Complications of Sinusitis. Jose Ameriso, de otorrinolaring. **3**:213 (March) 1944.

itial site of involvement of an orbit in sinusitis ly related to a pathologic area in a specific sinus. names four sites and sources of involvement: raorbital, from the frontal sinus; (2) infrarom the maxillary sinus; (3) retro-orbital, from noid sinus; (4) interorbital, from the ethmoid He further discusses the orbital anatomy and the importance of the thin lamina papyracea as frequent avenue of the transmission of infection rbit.

ching the orbit the infection involves the mucous e of the sinus wall, the periosteum, the bone lly the orbital periosteum. The extension may rough a dehiscence in the wall or by the way veins, the lymph channels, the sheaths or a s. If the pathologic process is limited to the orbital periosteum, an interosteoperiosteal abscess is formed. This subjects the orbit to a number of pathologic conditions. The optic nerve is extremely sensitive to inflammation and blindness can occur readily. Trophic changes in the eyeball may be caused by involvement of the ophthalmic ganglion and may produce exophthalmos, corneal ulcerations and even panophthalmitis. If the eyeball is involved through the lymphatics or by embolism, there may occur iritis, iridocyclitis, retinochoroiditis or scleritis.

The initial symptoms appear as palpebral swelling, redness, edema, a painful orbital wall, chemosis, exophthalmos and paresis of orbital muscles.

Should an abscess form, the symptoms are aggravated and then may include immobility of the eyeball, corneal anesthesia, amaurosis, papillitis and dilatation of the retinal vessels. Finally, either generalized septicemia or meningitis may occur. When exophthalmos appears, a differential diagnosis must be made from tenonitis, thrombosis of the cavernous sinus, osteoperiostitis and orbital abscess.

The treatment depends on the stage of the disease. If the infection is mild, intranasal therapy is sufficient. In doubtful cases of abscess, involvement of the cavernous sinus, phlebitis or bilateral infection, an external operation on the orbit and the sinuses is indicated. This is also true when the optic nerve is involved.

Persky, Philadelphia.

Miscellaneous

Effects of Repeated Use of Sulfadiazine for Recurring Acute Infections of the Respiratory Tract. Morris Siegel, Am. J. Dis. Child. **68**:23 (July) 1944.

Siegel, aided by a grant from the Metropolitan Life Insurance Company, undertook this study in the division of infectious diseases of the Public Health Research Institute of the City of New York. The problem was: Do sulfonamide drugs "wear out" on repeated ingestion, or do they "pile up" in the system and cause allergic manifestations? The literature contains arguments in support of both views. At Letchworth Village, an institution for the feebleminded, sulfadiazine has been used for about two years in the treatment of infections of the airways without serious mishap. In general, the average course of infections thus treated did not vary according to the number of such attacks in a given case. There were subcutaneous eruptions in 3 cases. The eruptions cleared up after withdrawal of the drug. Siegel concludes that in the period from October 1941 through June 1943, 184 children who received sulfadiazine were not adversely influenced. Some 99 of them were treated on two or more occasions. The recognizable toxic effects were infrequent and receded promptly on withdrawal of the drug. Dr. Siegel's experience leads him to state that "frequency of sensitization to sulfadiazine and of cumulative damage to organs and tissues must be considered of a low order." The article contains many citations from the literature on this subject.

Voorhees, New York.

The Role of Ciliary Action in Production of Pulmonary Atelectasis, Vacuum in the Paranasal Sinuses, and in Otitis Media. A. C. Hilding, Ann. Otol., Rhin. & Laryng. **52**:816 (Dec.) 1943.

Hilding briefly reviews some of the work done in the study of atelectasis and some of the physiology. In breathing, the lungs rise and contract, and the air

passages shorten and become narrower. The diameter of the bronchi is said to vary as much as one third. The normal respiratory tract is lined throughout with a thin film of mucus, and this entire film is removed by ciliary action perhaps one to three times each hour and constantly replaced by the mucous glands. The total amount of mucus present at any time is small, but the respiratory mucus tends to span spaces, forming bubbles, diaphragms and threads. It has a certain tensile quality and can be dragged for a considerable distance. The cilia transport it readily and apparently can carry one hundred times the normal load without difficulty. The author, feeling that this mucus and the ciliary action might be a factor in the development of atelectasis and vacuum sinusitis, carried out several series of experiments. Using a short section of a chicken's trachea and respiratory mucus from a number of hens, he was able to demonstrate that the ciliary action carrying the plug of mucus along produced a negative pressure of 34 mm. of water within eighteen minutes. The greatest negative pressure in all the experiments was 35 mm. of water. He explains the development of the vacuum by the piston-like action of the mucous plug in the trachea and feels that the steps leading to atelectasis are on the same basis. He says that the following circumstances combine to cause the occlusion: the force of the inspiratory flow of air, the changes in diameter and length of the bronchus, the bellows-like action of the involved lobe and the viscosity and the volume of the secretion. The occluding mass of mucus advances up the bronchus, causing a reduction of pressure in the lobe. The elastic tissue of the lobe reduces the size of the lobe as the pressure falls. The alveoli of neighboring lobes are carried forward by inspiratory air into the space which is relinquished by the affected lobe. The sliding movement of the lungs during respiration facilitates the shrinkage of the affected lobe and the enlargement of the neighboring lobes. These steps must be repeated many times with a succession of mucous plugs, each carrying along a volume of air somewhat on the principle of a mercury vacuum pump.

Hilding thought this same principle might explain the development of vacuum sinusitis and conducted experiments on dogs. Holes were drilled in the frontal sinuses of dogs, on both sides, of a size to hold an 18 gage hypodermic needle tightly. A needle on each side was connected with a water manometer. A second hole was drilled into the left side, a quantity of mucus was injected into the sinus and the needle was promptly closed. Negative pressure began to develop in the left sinus within a few minutes. Clinically vacuum sinusitis would develop when sufficient mucus reached the ostium to fill it completely and no incoming air could pass by. The pressure fell as the mucous mass was progressively dragged by nasal cilia and pushed by the sinus cilia through the ostium.

Some attempts were made to produce a vacuum in the middle ear by injecting mucus into the hypotympanum and the first part of the eustachian tube, but were unsuccessful. Nevertheless the author believes that negative pressure in the middle ear is probably due to the force of ciliary action moving mucus down the tube.

M. V. MILLER, Philadelphia.

THE LOCAL USE OF SULFADIAZINE SOLUTION, RADON, TYROTHRICIN AND PENICILLIN IN OTOLARYNGOLOGY. S. J. CROWE, Ann. Otol., Rhin. & Laryng. **53**:227 (June) 1944.

It has been found that disorders of the ears and sinuses are frequent causes of disability in the armed forces, particularly among aviators, submarine crews and deep sea divers. The men in the tropics, as as those in the colder and damper climates, have known to undergo excessive hyperplasia of the lymp tissue in the pharynx and the nasopharynx. predisposes to colds and nasal involvement. In subject to great changes of air pressure in either air or the sea, the lesions of the ears and sinuses be purely mechanical and are designated as aero- media or aerosinusitis in American literature. British, however, use a more descriptive word, b trauma. Crowe believes that these patients ma readily helped by application of a solution of s diazine to discourage the nasopharyngeal growt bacteria and by beta and gamma irradiation of pharynx and nasopharynx to remove hyperplastic ti He uses Pickrell's solution, and the patient is instr to put one-half medicine dropper of the solution each nostril, allowing it to flow along the floo the nose into the nasopharynx and the pharynx. should be repeated ten to twelve times a day for days, and four to six times a day for an addi week. Most of this drug is swallowed and is of value since the blood level rarely exceeds 1 mg. hundred cubic centimeters after a full course of treatment. However, some of the drug is absorbe the lymphoid tissue, and, as studies previously rep indicate, the concentration soon reaches a level inhibits the growth of pyogenic bacteria. At the J Hopkins Hospital from 800 to 1,000 millicuries of r is used with a brass filter 1 mm. thick, but for u the Army, the civilian hospital or the office a practical applicator contains 50 mg. of anhyd radium sulfate. The results of treatment with have been as good as those attained with radon, the time of treatment is only six and six-tenths mi In cases of disease of the ears the hearing has improved and chronically discharging ears have quently become dry.

The use of tyrothricin and penicillin requires one know the organism being dealt with. Tyroth is truly bactericidal and when brought into co with a sensitive organism kills almost instantly. penicillin and sulfonamide compounds are bacteri and must be in contact with bacteria for several h in order to produce a lasting effect. Tyrothric insoluble in water and does not penetrate tissues locally applied. It is extremely toxic when inj into the tissues or into veins. Penicillin, on the hand, penetrates tissues well, and for this reason value in the treatment of local infections, pro the concentration in the wound can be kept at the p level over a sufficient length of time.

M. V. MILLER, Philadelph

TRIGEMINAL NEURALGIA DUE TO RADICULAR LES W. B. HAMBY, Arch. Surg. **46**:555 (April) 19

Lesions in the vicinity of the intracranial portio the fifth nerve may cause trigeminal pain, which assume the character of true tic douloureux. Tum aneurysm in the middle fossa, compressing the gass ganglion and its peripheral branches, occasionally c a ticlike pain, but as a rule there is also a backgr of steady burning pain and numbness. Neoplasm the cerebellopontile angle encroach on the sensory of the trigeminal nerve and may produce a pain wh indistinguishable from that of idiopathic trige neuralgia. Since with such tumors trigeminal pain be the first or the most conspicuous symptom, evi of involvement of other cranial nerves must be care sought for.

The author reports 4 cases of cerebellopontile plasm (2 of epidermoid, 1 of meningioma and

tic neuroma) in which at first only the diagnosis geminal neuralgia was made and the signs of a in the cerebellopontile angle were minimal and appearance. It is worthy of mention that periphjection of alcohol or customary section of the root temporal approach may relieve pain caused by a of the trigeminal root in the posterior fossa. patient with trigeminal neuralgia should be careexamined for the possible presence of a lesion in osterior fossa, especially if the patient is young. such circumstances it is advisable to perform inal rhizotomy by Dandy's posterior approach, ross lesions of the cerebellopontile angle be over-. For the same reason, the cerebellopontile angle be explored when trigeminal tractotomy is to erformed in the medulla. Although trigeminal omy by the cerebellar route is safe in skilled , the subtemporal approach is preferable for the ent of trigeminal neuralgia in the elderly patient, s usually a poor operative risk.

LIST, Ann Arbor, Mich.
[ARCH. NEUROL. & PSYCHIAT.]

BACTERIOLOGY OF BRAIN ABSCESS. ALLAN M. CFARLAN, Brit. M. J. **2**:643 (Nov. 20) 1943.

cFarlan reports the bacteriologic observations in es of cerebral abscess seen in neurosurgical clinics. ylococcus aureus, the commonest organism, was nt in 15 of the 48 cases. The next in order of ency were the fusiform bacilli and the anaerobic ococci, each type being noted in 10 cases. Strepcus pneumoniae, Proteus vulgaris and Streptococgenes were isolated in several cases. McFarlan attention to the fact that several authors have ered the streptococcus as the commonest offender, he results of culture in his series suggest that l species may have been represented. For this n, he believes that anaerobic culture should be an essential part of the examination of pus from an abscess of the brain. In 33 cases only one organism was found; in 14 cases more than one organism was recovered, and in 1 case the specimen was sterile. Because of insufficient data, it was impossible to draw any conclusions about the time relations of capsule formation or to compare the abscesses due to different organisms with regard to speed of encapsulation. Although it has been repeatedly stated that anaerobic and gram-negative bacilli inhibit capsule formation, there were 2 cases in the author's series in which fusiform bacilli were isolated and the abscess was shown histologically to be well encapsulated; this was also true in 2 cases of abscess from which P. vulgaris was isolated.

ECHOLS, New Orleans.
[ARCH. NEUROL. & PSYCHIAT.]

News and Comment

OFFICERS OF THE AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY, INC.

The second annual meeting of the American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc., was held on Nov. 10, 1944, and the following officers were elected: president, Dr. Morris S. Bender; vice president, Dr. Alfred Schattner, and secretary, Dr. Jacob Daley—all of New York; treasurer, Dr. Benjamin H. Shuster, Philadelphia. Dr. Matthew S. Ersner, Philadelphia; Dr. Nathan A. Bolotow, Providence, R. I., and Dr. John P. Baker, New York, form the board of directors.

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NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

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Secretary: Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.

In compliance with the request of the Office of Defense Transportation and in the interest of the national war effort a meeting will not be held in 1945.

American Academy of Ophthalmology and Otolaryngology

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American Laryngological Association

President: Dr. Harold I. Lillie, Mayo Clinic, Roch Minn.

Secretary: Dr. Arthur W. Proetz, Beaumont St. Louis.

Place: Drake Hotel, Chicago. Time: May 30-31,

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Albert C. Furstenberg, University pital, Ann Arbor, Mich.

Secretary: Dr. C. Stewart Nash, 708 Medical Bldg., Rochester 7, N. Y.

Place: Drake Hotel, Chicago. Time: May 28-29,

SECTIONS:

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Southern.—Chairman: Dr. Verling K. Hart, 10 7th St., Charlotte, N. C.

Middle.—Chairman: Dr. Carl H. McCaskey, 608 C anty Bldg., Indianapolis.

Western.—Chairman: Dr. Aubrey G. Rawlins, 384 St., San Francisco.

American Otological Society

President: Dr. Gordon Berry, 36 Pleasant St., cester, Mass.

Secretary: Dr. Isidore Friesner, 101 E 73d St., York.

Place: Drake Hotel, Chicago. Time: June 1-2,

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

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